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CHARLES ELMORE CROPLEY
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IN THE

Supreme Court of the United States

OCTOBER TERM, 1934.

Nos. 255 and 256.

ALTOONA PUBLIX THEATRES, INC.,
Petitioner,

and

WILMER & VINCENT CORPORATION and LOCUST STREET REAL ESTATE COMPANY,
Petitioners,

vs.

AMERICAN TRI-ERGON CORPORATION and TRI-ERGON HOLDING, A. G.,
Respondents.

APPENDIX TO RESPONDENTS' BRIEF.

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May 21, 1929. H. VOGT ET AL 1,713,726

DEVICE FOR PHONOGRAPHS WITH LINEAR PHONOGRAM CARRIERS

Filed March 20. 1922 3 Sheets-Sheet 1

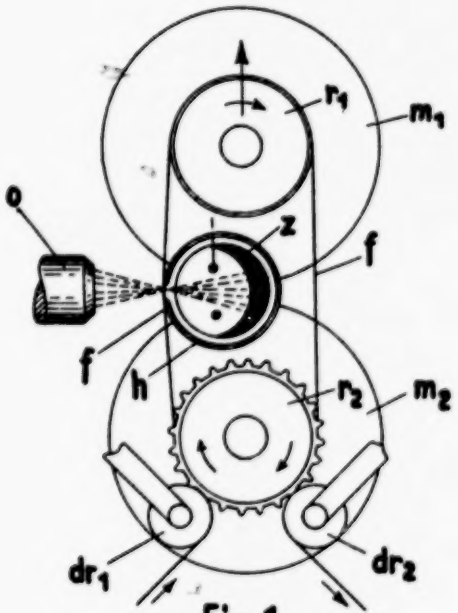

Fig 1

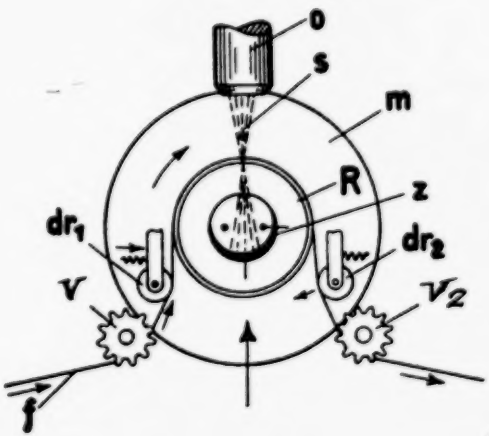

Fig. 2

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May 21, 1929. H. VOGT ET AL 1,713,726

DEVICE FOR PHONOGRAPHS WITH LINEAR PHONOGRAM CARRIERS

Filed March 20. 1922 3 Sheets-Sheet 2

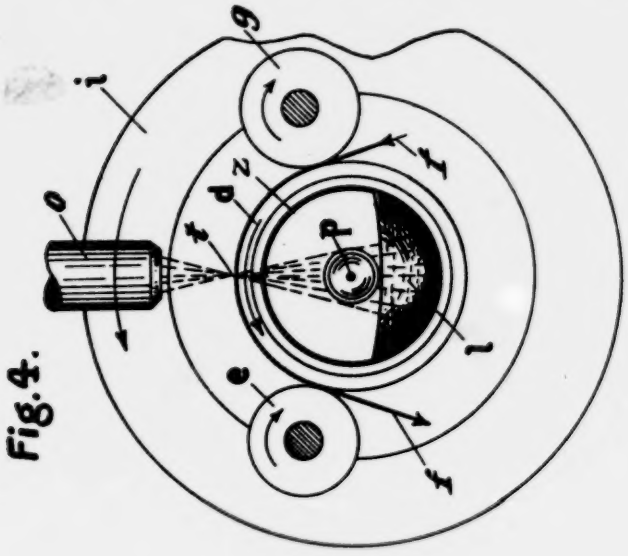

Fig.4.

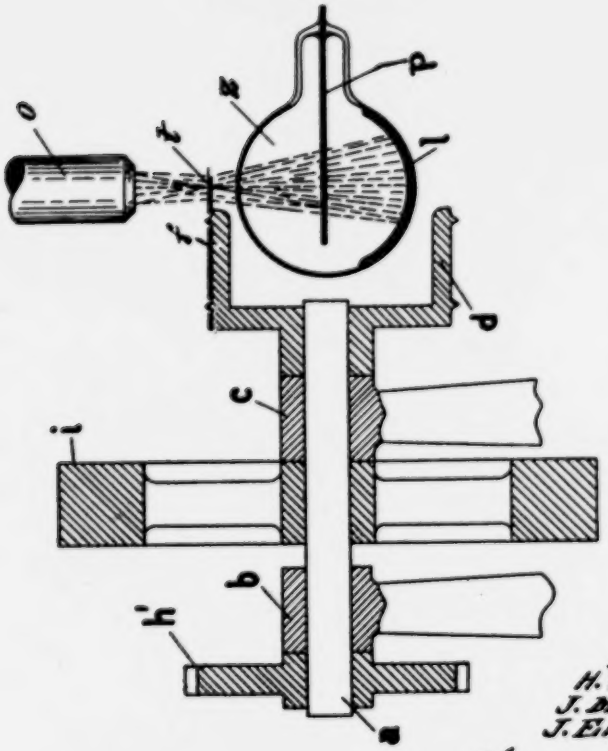

Fig.3

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May 21, 1929. H. VOGT ET AL 1,713,726

DEVICE FOR PHONOGRAPHS WITH LINEAR PHONOGRAM CARRIERS

Filed March 20, 1922 3 Sheets-Sheet 3

Fig. 6.

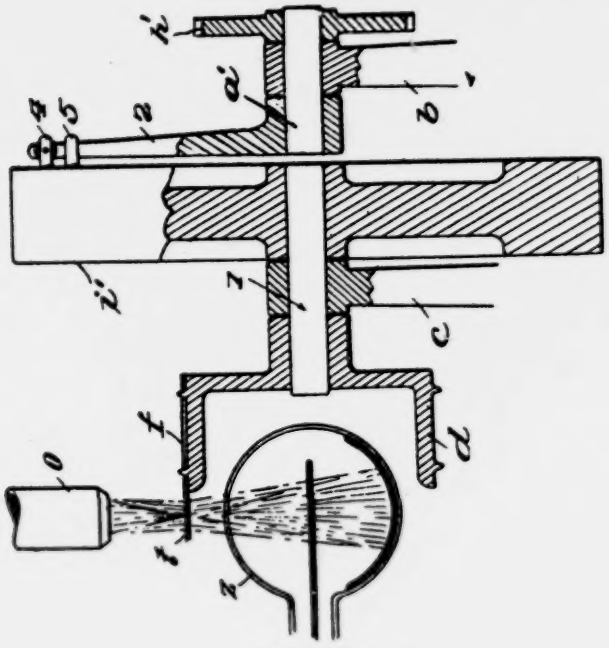
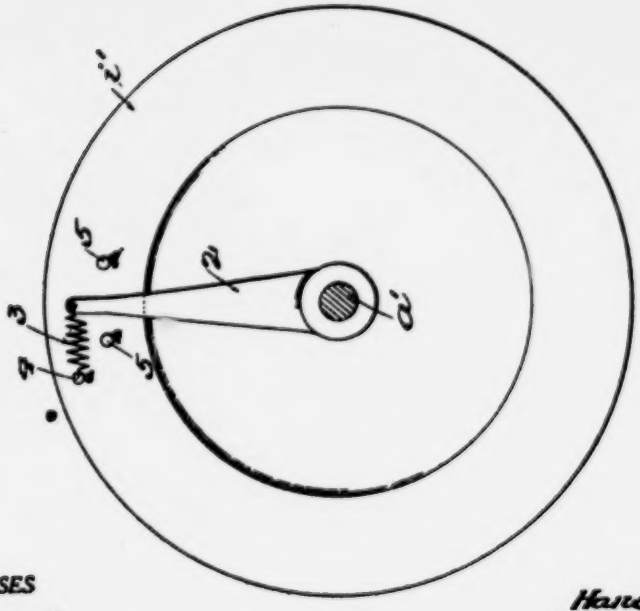


Fig. 5.



WITNESSES

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SPECIFICATION* OF PATENT IN SUIT (VOL. III, PP. 5-10).

Patented May 21, 1929. 1,713,726

UNITED STATES PATENT OFFICE.

HANS VOGT, OF BERLIN-WILMERSDORF, AND JOSEPH MASSOLLE AND JOSEF ENGEL, OF BERLIN-GRUNEWALD, GERMANY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO WILLIAM FOX, OF WOODSBURGH, NEW YORK.

DEVICE FOR PHONOGRAPHS WITH LINEAR PHONOGRAM CARRIERS.

Application filed March 20, 1922, Serial No. 545,377, and in Germany March 24, 1921.

The recording and the reproduction of sound waves by the use of linear phonogram carriers such as film strips, steel wires, and so forth, can only be effected in absolutely satisfactory manner, even after the removal of all other occurring difficulties, when the speed of the record carrier is uniform both for the receiving and the reproduction, and when in both cases no variations of any kind occur. Especially in the case of musical reproductions is the record extremely sensitive to the slightest variations of speed. Consequently, it has hitherto been usual to provide apparatuses such as phonographs and gramophones with speed regulators. In these apparatuses, however, the problem of the uniform motion does not assume the same importance as in the case of sound recording or reproducing

*The specification as here reprinted includes the corrections of printer's errors in the original patent, in accordance with the certificate of correction (Vol. III, p. 10).

apparatus embodying linear phonogram carriers, such as photographic sound records on film strips or ribbons because with the former the record carrier consists of a cylinder or disc possessing a somewhat considerable momentum when the desired velocity is imparted thereto which equalizes any small irregularities in the motion, such as may be caused, for instance, by the driving mechanism. In the latter case, however, that of phonographs with linear records, such as film strips, the portion of the record which is active at a given moment possesses practically no momentum to be taken into consideration. Irregularities in the motion, such, for instance, as may be caused by the projections, the teeth, the belts, the connecting places, and so forth, or by the friction, at the guiding point (the slot, the magnet, the condenser), become consequently very much more important with these and thus greatly impair the periodicity of the sound recorded.

According to the present invention, this draw-back which attaches to all hitherto known propulsion mechanisms for linear phonogram records is obviated by the arrangement, that the light sound record has given to it at the controlling point the property of a weighty mass. This is attained by the arrangement that the record carrier (a film strip or the like) is firmly pressed against one or more rollers connecting with a heavy rotating mass, so that the record moves in exact conformity with the rollers and the rotating mass.

Also, according to the present invention a dependable and highly efficient optical system is provided for use in conjunction with moving film strips of the above indicated character.

Various further and also various more specific objects, features and advantages will more clearly appear from the detailed description given below taken in connection with the accompanying drawings, which form a part of this specification.

The invention consists in such novel features, arrangements and combinations of parts and methods as may be

shown, described and claimed in connection with the embodiments of the invention herein disclosed by way of example only.

Constructional examples of the invention are illustrated in the figures, in which:—

Figure 1 is a side elevation of a linear phonogram carrier.

Figure 2 is a side elevation of a modified form of phonogram carrier.

Figure 3 is a longitudinal section of another form of phonogram carrier.

Figure 4 is an end view of the form of carrier shown in Figure 3.

Figure 5 is a view in elevation of a fly wheel showing an elastic coupling adaptable to the rear side of the fly wheels, the face views of which are shown in various of the other figures.

Figure 6 is a vertical section of the same.

Referring to Fig. 1, partially illustrating sound reproducing apparatus, the phonogram carrier, which in these illustrations is shown as a film strip bearing a photographic sound record, moves over the rollers r', r^2, suitably coupled by gearing or belting, of which rollers, preferably the roller r^2 directly driven by the motor is provided with teeth. One or even both rollers are rigidly connected with rotating masses as at m', m^2, which give to the film strip f travelling between them under tension the requisite uniformity of its motion. Between the rollers r', r^2, there is placed preferably in a casing h the light-sensitive cell z sensitive to electric light, which is influenced by a light ray passing from a light source (not shown), through objective o, and then through the film. The rollers or idlers dr', dr^2, press the film against the carrier roller r^2.

Another construction of the invention is shown in Fig. 2, in which the little irregularities of movement often caused by the feeding of the film by the teeth on roller r^2, in the Fig. 1 construction, or which are caused by the me-

chanical vibrations of the stretches of film between rollers r' and r^2, in the Fig. 1 construction, are avoided.

The film *f* is drawn by the sprocket V to the controlling point *s* and is removed from the controlling point by the sprocket V^2. Between these feeding sprockets, the film is guided over the periphery of a larger roller R on which it rests closely by friction, even during the turning motion. As the roller is rigidly connected with the rotating mass *m*, or can be constructed so as to be itself the rotating mass, the film moves uniformly on in like manner as the surface of the roller R. For the purpose of pressing the film upon the roller R, and for the equalizing of irregularities of motion, there are provided the spring-supported rollers dr', dr^2. That is, the spring pressed rollers engaging the film at points between the feeding rollers and the fly wheel roller, thus exert resilient pressure against the film to force the film into effective engagement with the fly wheel and thereby at the same time the film is deflected from a straight line position, the extent of such deflection varying slightly with any irregularities in the movement of the film and its resulting tension, with the result that any such irregularities are effectively prevented from being imparted to the film at the point of translation. The light rays required for the illumination or the transmission of light through the film are thrown upon the film in the form of a narrow line by means of the objective *o*. When sound is to be reproduced from the photographic sound record on the film, the light rays pass through the film strip and fall upon the photo cell *z* preferably placed in the interior of roller R. For this purpose, the roller is either partially transparent, made of glass, for example, or the part of the film bearing the sound record projects beyond the non-transparent parts of the roller.

In the hereinbefore described form of execution of the invention the driving of the film sound record is however not effected directly at the point of projection but in front or behind the same. The driving point of the film can

however, in a further development of the invention, be arranged directly at the point at which light is projected through the record. The driving member can, in this case, be constructed in such a manner that the engaging and disengaging, of the feeding teeth of the film-feeding sprocket with the perforations of the film, will not affect the speed of the film at the projection point, i. e., at the point at which light falls upon the film in recording, or at which it passes through the film in reproducing.

Figures 3 and 4 show this form of construction by way of example. The shaft *a* journalled at *b* and *c*, carries at one end the feeding-cylinder *d* which has the customary teeth designed to engage with the perforations of the film. The film *f* is in contact with one part of the circumference of this cylinder, the length of this part corresponding with the distance between the pressure rollers *e* and *g*, Fig. 4. The driving member *h'* such as a gear for example, and also the fly wheel *i*, are keyed upon this shaft and designed to communicate to the shaft and consequently to the cylinder *d*, a uniform revolving speed. The film will consequently move also with uniform speed, for instance in the direction *g—e*. These rollers *e—g* press the film strip firmly against the cylinder *d* so that it lies, without possibility of being shifted, upon the entire peripheral length of cylinder *d* from *g* to *e*, because of the feed teeth of cylinder *d* engaging with the perforations of the film. The engagement and disengagement of the feed teeth on cylinder *d*, with the perforations of the film, takes place under the pressure of the rollers *g* and *e*, Fig. 4, so that vibrations or jerky motions of the film band, due to such tooth engagement or disengagement, no longer make themselves felt at the point of light projection through the same. The free ends *f—f* of the film band are preferably guided by rollers (not shown) for preliminary winding up in the manner well known in picture cinematography, so that they form a loop.

It will be understood that the invention is intended particularly for use in connection with transparent film rec-

ords, on which sound is recorded photographically, by causing acoustically modulated light to act upon the film at the control point. Also that, in reproducing, light passes through the sound record on the film at the control point, and falls upon the photo-cell *z* to set up currents corresponding, in frequency variations, to the sound record through which the light has passed. Also, that the film may pass from a supply reel on which it is wound, at the starting end, to a reel on which it is progressively wound, at the final end, as is usual in cinematography. Further, that the film contemplated may be a talking moving picture film, containing pictures in addition to the sound record. Such a record must be fed intermittently past the point at which the pictures are recorded on the film, or at which the projection light shines through the pictures in reproducing. In addition there is need of feeding the film uniformly past the point at which the sound is recorded or reproduced. For such film the loop referred to is preferably formed, between the point of intermittent feed for picture recording or projection, and the point of uniform motion for sound recording or reproducing, the production of such loops in the film being common in cinematography.

For recording purposes a solid cylinder or roller may be employed in place of the roller *d* upon which the full width of the film strip will bear, since in recording the acoustically modulated light which is to be recorded need not pass through the film but only need act upon the sensitized upper surface thereof.

For reproducing purposes, a specially constructed roller *d* is required. This is for the reason that the light from the projection light source, condensed by the lens *o* to a narrow line at the surface of the film, must pass through the film and fall upon a light-sensitive element, for instance the cell *z* with the cathode *l* and anode *p*. The cylinder or roller *d* in Figure 3 shows a form of construction by way of example in which the part of the film which carries the sound record projects beyond the edge of the cylinder.

The light collected by the object glass *o* to a narrow line, comes from a suitable known means or source of light projection so arranged, as indicated for example by the dotted lines in Figs. 3 and 4, that the converged narrow line of light is substantially focused or impinges upon the area of translation *t* on the film as a line running transversely of the direction of movement of the film.

Certain features of this type of optical system are also disclosed in our Patent No. 1,590,185, issued June 29, 1926, application for which was filed on April 4, 1921, and the claims of which patent relate to divisional subject matter.

The sound record as indicated in Fig. 3 may be located at the outer side of one row of perforations in the film. The sound record markings, can, however, if desired, be located between the two rows of perforations in the film, in which case only one row of perforations would be utilized for feeding the film, these perforations being engaged by the teeth on roller *d* nearest to the center of cell *z*. In this case the sound record portions of the film would still overhang the edge of roller *d*, the far overhanging edge of the film, moving along either without a special guidance or running over a roller with or without feeding teeth, which roller may be an idler or may be specially driven, as desired.

Another feature may advantageously be incorporated in the invention. If the driving shaft of the tone-film revolves with a low number of revolutions and if a rigid drive is used, the circumferential speed of fly wheels which can be practically utilized, will, under certain conditions, not be sufficient for compensating the speed fluctuations.

According to the invention the driving of the fly wheel axle is therefore effected with the aid of an elastic coupling, for instance a spring. This spring can be very feeble as, at constant speed, it has to overcome only the losses from friction of the driven part. As however, at the starting and stopping of the driving mechanism, the inertia of the

fly wheel has to be overcome, it is advantageous to limit the play of the spring in either direction by a fixed stop.

Figures 5 and 6 show such a form of execution by way of example. The axle *l* of the wheel with the rotating mass *i'* is separate from the driving shaft *a'*. Upon the latter a lever 2 is arranged which drives the rotating mass through the intermediary of the spring 3 and of the stud 4 fixed to the fly wheel. The studs 5 which are also fixed on the fly wheel limit the stroke of the lever 2 at the starting and at the stopping so that the spring 3 is protected against excessive tension and against jumping out of position.

While the invention has been described in detail with respect to certain particular preferred examples which give satisfactory results, it will be understood by those skilled in the art after understanding the invention that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

CLAIMS RELIED ON, AS GRANTED, WITH DISCLAIMER APPLIED.

(Under ¶a of the disclaimer [Vol. III, pp. 227-8], the specification and claims are directed only to combinations and methods as embodied respectively in apparatus wherein and methods whereby sound is translated by light to or from a film strip moving uniformly past said light.)

Claim 5 (Vol. III, p. 8).

In phonographic apparatus in which the sound record is formed on an elongated ribbon of inconsiderable mass, having feeding perforations therein, the combination of means for supporting and progressing the record ribbon from one point to another point and past an intermediate point at which the record is made on the ribbon in recording or from which the record is taken from the ribbon in reproducing, including a toothed cylinder over a portion of which the ribbon passes adjacent to said intermediate point, the teeth of said cylinder engaging the perforations of the ribbon, a fly-wheel associated with said cylinder, and means for rotating said cylinder, under control of said fly-wheel at uniform speed.

As to "P.S. 1" machine*

Claim 7.

In phonographic apparatus in which the sound record is formed on an elongated carrier of inconsiderable mass, the combination of means for supporting and progressing the elongated carrier from one point to another point, and past an intermediate point at which the record is made on the carrier in recording or from which

As to "P.S. 1" machine

*Drawings of Petitioners' "P.S. 1" and "P.S. 16" types of infringing machines will be found at Vol. III, pp. 327-32.

the record is taken from the carrier in reproducing, including a cylinder over a portion of the periphery of which the carrier passes adjacent to said intermediate point, a fly-wheel, a shaft on which said cylinder and fly-wheel are both secured, a driving member coaxial with said shaft, a resilient connection between said driving member and fly-wheel, and stop means for limiting the amount of yielding of said resilient connection.

Claim 9.

As to "P.S. 1" and "P.S. 16" machines

The method of translating sound or similar vibrations to or from a film record by the use of light varied in accordance with the sound, which comprises flexing the film arcuately longitudinally at the point of translation and rapidly and uniformly moving the film in a circumferential direction past said point.

—wherein the uniformity of movement of the film past the translation point is effected by subjecting the portion of the film passing said point to the control of the inertia of a rotating weighty mass (see disclaimer ¶b, Vol. III, p. 228).

Claim 13.

As to "P.S. 1" and "P.S. 16" machines

An apparatus for reproducing speech, music or the like sounds from vibrations recorded on a film, by the use of a line of light varied in accordance with the sound, comprising a photoelectric cell, means for imparting to the film a rapid and uniform motion longitudinally of the film past said cell, a source of light projection for providing said light, and an objective lens in the path of said light and spaced from the film for directing said light as a converging narrow line impinging on the film at a point in the region of the focal point of said lens, said

light passing through the film and on to said cell, the space between said lens and the film being free of obstructions to said light.

—wherein a flywheel is operatively connected with the film through means which imparts uniformity of motion of the flywheel to the film (see disclaimer ¶c, Vol. III, p. 228).

Claim 17.

In phonographic apparatus in which the sound record is formed on an elongated carrier of inconsiderable mass, the combination of means for supporting and progressing the elongated carrier from one point to another point, and past an intermediate point at which the record is made on the carrier in recording or from which the record is taken from the carrier in reproducing, including a cylinder over a portion of the periphery of which the carrier passes adjacent to said intermediate point, a fly wheel operatively associated with said cylinder, said carrier progressing means operating to advance the carrier past said intermediate point at uniform speed under the control of said fly wheel.

As to "P.S. 16" machine

—wherein a sprocket engaging the carrier forms a part of the carrier progressing means and a substantial portion of the periphery of the cylinder is in contact with the carrier in its travel from the intermediate point to said sprocket (see disclaimer ¶d, Vol. III, p. 228).

Claim 18.

The method of translating sound or similar vibrations to or from a film record by the use of light varied in accordance with the sound comprising rapidly advancing the film past the point of translation, and subjecting the motion of the film in passing said point, to the control of inertia means to effectively eliminate irregularities in the movement of the film.

As to "P.S. 1" and "P.S. 16" machines

—wherein the inertia control is effected by passing the film over a rotating member and so applying inertia thereto as to eliminate substantially all irregularities in its rotation (see disclaimer ¶e, Vol. III, p. 228).

Claim 19.

As to "P.S. 1" and "P.S. 16" machines

The method according to claim 18, and in which the film is yieldingly pressed into contact with a supporting area immediately adjacent the point of translation, such pressure cooperating with the inertia control in the elimination of irregularities in the film motion.

—wherein the inertia control is effected by passing the film over a rotating member and so applying inertia thereto as to eliminate substantially all irregularities in its rotation (see disclaimer ¶e, Vol. III, p. 228).

FINDINGS OF FACT AND CONCLUSIONS OF LAW PROPOSED BY THE PARTIES, FOUND BY THE COURT AND FILED WITH ITS OPINION.

RESPONDENTS' PROPOSED FINDINGS OF FACT FOUND BY THE COURT.

1. Broadly speaking, the patent in suit relates to phonographs or sound heads with linear sound records, but more specifically to apparatus and methods whereby sound is translated by light to or from a photographic film strip. The specification and drawings describe and show *no other* apparatus or method than those involving a film strip with a photographic sound record, i. e., wherein the sound is translated by acoustically modulated light. (See all pat. dwgs. [Vol. III, pp. 1-3] more clearly in Figs. 3 and 6; and specification throughout [Vol. III, pp. 5-10], for example, p. 1, line 91; p. 2, line 1; lines 41-50; lines 112-114; 126; p. 3, line 17; Ballard, Vol. I, p. 254.*) Vol. II, p. 1037

2. The character of light by which the sound is translated to or from the film is described as a narrow line of light focused on the film, and it is shown in the drawings as focused to a very fine line. (Pat., p. 2, lines 42-45; p. 3, lines 33-42 [Vol. III, pp. 6-7]. See drawings [Vol. III, pp. 1-3], and Ballard, Vol. I, pp. 261-2; 442, XQ418.) Vol. II, p. 1037

3. The film strip is shown in the drawings (more clearly in Figs. 3 and 6) as a perforated film strip with Vol. II, p. 1037

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*The findings and conclusions as printed in the record embody page references to the typewritten record. We have therefore reprinted the findings and conclusions in this appendix with corresponding references corrected to conform to the printed record.

the sound record on the margin and with the portion between the sprocket holes left for the pictures, but the specification also states that the sound record may be located on the film strip between the two rows of sprocket holes. (Pat., p. 3, lines 49-54 [Vol. III, p. 7].)

Vol. II, p. 1037

4. The apparatus is especially useful for sound on film sound pictures. The claims in suit are not limited to the use of the apparatus for sound pictures but the apparatus is directed to a sound on film sound head in an organization especially designed with a view to the production of sound on film sound pictures, since the sound track is arranged on the film alongside of the pictures and the apparatus is so organized that it may be placed above or below the picture projection head and have the film run from one to the other with the protecting loops in the film where it enters and leaves the sound head mechanism. (Ballard, Vol. I, p. 256; pat. [Vol. III, pp. 6-7], p. 2, lines 105-9; line 125 to p. 3, line 12.)

Vol. II, p. 1038

5. The patent describes several features which cooperate to give high quality sound on film sound reproduction, i. e., without appreciable sound distortion, in order to attain sound reproduction sufficiently realistic to accompany motion pictures. These features are:

(1) Means for momentarily giving the short active length of film in the sound head the property of a weighty mass in such manner as to obtain a high degree of uniformity of speed at the translation point.

(2) Utilizing a focused fine line of light, now known as an "optical slit", for recording and reproducing (instead of a mechanical slit directly against the traveling film, thus avoiding accumulation of dirt at this point which resulted in obstructions to the light at the mechanical slit and the scratching of the sound records).

(3) Arcuately bending the film at the translation point (this prevents certain difficulties, including elimination of irregular depressions at sprocket holes and the natural transverse curling of such film, which would throw the fine line sound track out of the focal plane of the line of light and thus distort the sound); and

(4) The use of a photoelectric cell for reproducing the sound (this gives instantaneous and true proportional response of the cell to the action of the line of light thereon to prevent distortion of the sound). (See pat. [Vol. III, pp. 1-10] and references supporting findings 7, 8, 9 and 10 on each of the four points.)

6. Each of said four features of Finding 5 is also disclosed in the original application as filed. (See original application, Pltf.s' Ex. 1, Vol. III, p. 11; and same references as supporting findings 7, 8, 9 and 10.) Vol. II, p. 1039

7. In each of the constructional forms shown in the patent, the film is either wrapped around a substantial portion of the flywheel roller under tension so as to avoid relative slippage one with respect to the other, or is passed over a substantial portion of a flywheel-sprocket to insure meshing with a number of the teeth of the sprocket so that in both cases the portion of the film engaging the member secured to the flywheel, is definitely harnessed to it to prevent relative movement so that the film moves in exact conformity with the member secured to the flywheel and thus has given to it at the translation point, the property of a weighty mass. (See all the pat. dwgs. and description in specification [Vol. III, pp. 1-7].) Vol. II, p. 1039

8. The focusing of the light to a fine transverse line upon the film at the translation point, as distinguished Vol. II, p. 1039

from using a small mechanical slit against the film, is known as an "optical slit" and is shown in the drawings and described in the specification. The line of light source which is focused is disclosed in the patentees' patent No. 1,590,185 (Pltf.s' Ex. 7, Vol. III, p. 270) referred to in the specification of the patent in suit at page 3, line 45. (See same references as to finding 2; and Ballard, Vol. I, pp. 261-266; Vol. II, p. 875; Vol. I, pp. 441-2, XQ417.)

Vol. II, p. 1040

9. The film is shown bent arcuately longitudinally at the translation point in the construction of Figs. 2 and 3-4, by being wrapped around a portion of the roller or sprocket at the translation point. (Vol. I, pp. 271-75; Vol. II, pp. 914-5; Vol. I, pp. 277-8.)

Vol. II, p. 1040

10. A photoelectric cell is shown as the light sensitive element at the translation point in each of the three forms of apparatus of the patent, being located in Fig. 1 in the cylindrical casing *h* and in the other forms being located at the axis of the film sprocket or roller. (Ballard, Vol. I, pp. 266-268; Waterman, Vol. II, pp. 714-15, XQ242; XQs246-48.)

Vol. II, p. 1040

11. Suitable circuits for the photoelectric cell were disclosed in the patentees' pending earlier application (Pltf.s' Phys. Ex. 8, filed in the United States, April 4, 1921, under the Nolan Act, with effective date of its corresponding German application of March 3, 1919. Pltf.s' Phys. Ex. 9; also Judge Adkins' Findings of Fact Nos. 4-15; 33-4, found at Vol. III, pp. 279-85; 292-3).

Vol. II, p. 1040

12. The patent shows and describes three constructional examples of the invention: One in Fig. 1; another in Fig. 2, and the third in Figs. 3 to 6 (Vol. III, pp. 1-3). In each a flywheel is connected directly with a film-engaging sprocket or smooth roller, as the case may be, the sprocket or roller being either at or adjacent to the translation point. (Also see same references as to finding 7.)

13. In the construction of Fig. 1 (Vol. III, p. 1) the translation point is between a film-engaging smooth roller *r*1 and a film-engaging sprocket *r*2, over a substantial portion of each of which the film engages and each of which has a flywheel on its shaft; but the specification teaches that either of the flywheels may be omitted (p. 1, line 96 [Vol. III, p. 5]). In either case the translation point is located adjacent the flywheel roller *r*1 or the flywheel sprocket *r*2. If the flywheel is omitted from the sprocket *r*2 then the construction is one where the flywheel speed control is due to the film passing over a substantial portion of the smooth roller *r*1 around which the film is wrapped and held into engagement under tension and to which the flywheel is secured. If the flywheel is omitted from the shaft of the smooth roller *r*1 then that roller acts as a guide and feeding means for passing the film from the sprocket *r*2 past the translation point and back to the sprocket so as to hold the film in position against the member *h* at the translation point; and the flywheel control results from the flywheel on the shaft of the sprocket *r*2. The film is guided to and from, and pressed upon the sprocket by pressure rollers *dr*1, *dr*2. (See patent.) Vol. II, p. 1040

14. In Fig. 2 construction the film is fed by a sprocket V over a substantial portion of a smooth roller R to which is rigidly secured the flywheel *m*, and thence passes over a portion of the sprocket V2 which feeds it from the roller R. Spring-pressed means in the form of small rollers are provided to cause the film to tightly hug, under tension, the portion of the roller R over which it is wrapped. (See patent.) (Vol. III, pp. 1-10.) Vol. II, p. 1041

15. In the constructions of Figs. 3 to 6, inclusive, the film is fed over a substantial portion of a sprocket against which it is firmly pressed by rollers *e*, *g*. The flywheel is here again secured to the shaft of the sprocket. (See patent.) (Vol. III, pp. 1-10.) Vol. II, p. 1041

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16. The specification teaches that the flywheel may be driven by a spring which can be very feeble as, at constant speed, it has to overcome only losses from the friction of the driven parts (that is, the friction of the sprocket-flywheel assembly and the active portion of the film in the sound head); and that stops are provided to limit the play of the spring in the starting and stopping of the mechanism. This spring drive is proposed for use where the flywheel and its connected sprocket are to drive the film as in the construction of all of the figures but Fig. 2 where the flywheel-roller assembly is driven by the film and hence does not need this spring connection to isolate the assembly from the irregularities of the driving mechanism (pat., p. 1, lines 82-6; p. 3, lines 75-85 [Vol. III, pp. 5-7]; Engl, Vol. I, pp. 169-70; 206-7; Ballard, Vol. I, pp. 447-8).

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17. The flywheel with its film engaging sprocket or roller, is located on a shaft at or adjacent to the translation point, and in the preferred forms it is either isolated by the spring drive from the irregularities of the driving mechanism, or is isolated from the driving mechanism by being driven by the film. It is known as a "filter flywheel" (Engl, Vol. I, p. 98 and Ballard, Vol. II, pp. 879-80).

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18. The embodiments of the invention shown and described in the patent are operative and useful.

([a] as to the construction of Fig. 1, see Engl, Vol. I, pp. 92-97; Pltf.s' 2nd Tri-Ergon mach. Ex. 19a, Vol. III, p. 338; Vol. I, pp. 102-3; 198.

[b] as to the construction of Fig. 2, see Tri-Ergon mach. Pltf.s' Ex. 93, demonstrated to Court with performance beyond criticism by defendants; photos, Vol. III, pp. 356-8, Pltf.s' Exs. 29-31; Vol. II, pp. 789-91; 856-7; as to its construction see also, Vol.

I, pp. 237-8; also Vol. I, pp. 465-7 and Deft.s' Ex. 130, Vol. V, p. 1673 [magazine article]—re use by "Tobis."

[c] as to the construction of Figs. 3 to 6, see Tri-Ergon mach. Pltf.s' Ex. 89, demonstrated to the Court with performance beyond criticism by defendants; photos, Pltf.s' Exs. 90A, 90B, Vol. III, pp. 563-4; Vol. II, pp. 783-91; 855-7; 945-7; 954; also Pltf.s' Ex. 17, Vol. III, p. 335; Vol. I, pp. 98-100; 126-7; 103-5; 65-78; Pltf.s' Exs. 27a and 27b, Vol. III, pp. 353-4; Vol. I, pp. 108-111; 104-6; top 113; 215-18; Pltf.s' Exs. 23 and 24, Vol. III, pp. 343-4; Vol. I, pp. 224-7.)

19. The patentees demonstrated one of their machines substantially according to Fig. 1 of the patent, to outsiders in the spring of 1921; and one according to Figs. 3 to 6 of the patent later in 1921 with sound pictures; successfully commercially used one in 1922 in theatres in Berlin and others in Germany and Switzerland; in 1924-5 built others like Figs. 3 to 6 and used them commercially and their licensee used them thereafter, and built others like Fig. 2 of the patent in 1928-9. (Patent, Vol. III, pp. 1-10.) (See Engl's and Holborn's testimony [Vol. I, pp. 65-222] and certain exhibits included in citations in support of Finding 18.) Vol. II, p. 1043

20. A machine according to Fig. 2 of the patent (Vol. III, pp. 1-10) and a machine according to Figs. 3 to 6 of the patent were demonstrated to the Court with tone test records covering a wide range of tone frequencies; with a piano record of long sustained notes (used for testing such machines), as well as with speech and other music records, and the sound reproduction was very good; not even criticized by defendants. (See Tri-Ergon mach., Pltf.s' Phys. Ex. 93, demonstrated to the Court; photos, Pltf.s' Exs. 29-31, Vol. III, pp. 356-8; Vol. Vol. II, p. 1043

II, pp. 789-791; 856-7; see Tri-Ergon mach., Pltf.s' Ex. 89, demonstrated to the Court; photos, Pltf.s' Exs. 90A, 90B, Vol. III, pp. 563-4; Vol. II, pp. 783-791; 855-7.)

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21. Defendants' model (Deft.s' Ex. 79, Photo, Exs. 79A, B, C; Vol. V, pp. 1429-31) alleged to represent Figs. 3 to 6 of the patent (Vol. III, pp. 2-3), and built and operated to show that this form of machine was inoperative or commercially useless, was improperly constructed so as to distort the sound, and was not a fair representation of the construction and operation of the machine of Figs. 3 to 6 of the patent. (See Vol. II, pp. 751-3; 873-4; 753-4; 875-6.)

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22. The successful operation of plaintiffs' machine according to said Figs. 3 to 6 of the patent (Vol. III, pp. 2-3), without the added "shoe" which defendants contended had to be used, and without the special damping means alleged by defendants to be necessary, showed that said machine operated entirely satisfactorily without these features, and defendants introduced no evidence in support of their criticism, by argument, of the demonstration of plaintiffs' machine as given to the Court, or of the demonstration which the record shows was given to defendants after the demonstration to the Court. It appears from the record that after the demonstration to the Court, one or more of defendants' representatives informally criticized the machine in his or their talk with plaintiffs' representatives on the ground that certain driving gears were cut in a way that might create certain friction between two of the parts, but did not criticize the machine because its bearings were lubricated with grease; that, after this criticism, plaintiffs without admitting the merits of the criticism, but to avoid controversy, changed the cut of the gears to avoid the criticized point, and gave a second demonstration to defendants, and that defendants now criticize the machine, in argument only, on another ground, namely, that

grease was used to lubricate the bearings; but they have produced no evidence in support of either point, nor as to the successful use of the machine without the "shoe." Plaintiffs had a right to lubricate the bearings of their machine with grease. If the alleged inoperativeness of this embodiment of the invention is cured by such lubrication, there is no substance to defendants' contention of inoperativeness. (Vol. II, pp. 783-791; 855-7; 945-7; 954; 961.)

23. The disclosure or teachings of the specification and drawings of the patent are sufficient. (Engl, Vol. I, p. 219; Waterman, Vol. II, p. 644; Engl, Vol. I, pp. 169-170; 206-8; Ballard, Vol. I, pp. 448-9; 459; Waterman, Vol. I, p. 566; Vol. II, p. 671; Ballard, Vol. II, p. 876; and pertinent citations as to Finding 22.) Vol. II, p. 1045

23a. The patent in suit discloses apparatus and methods which enabled the successful establishment of a new and important art—sound on film sound pictures. (See citations for findings 18, 19 and 20.) Vol. II, p. 1045

24. Sound on film sound pictures are preferable to sound on disk sound pictures (the former avoids the difficulties of synchronizing the disk and the picture film; also the danger of using a wrong disk record with the picture record, and avoids editing difficulties where it is necessary to delete or change certain parts of the picture film which requires corresponding changes in the sound disk record). Sound on film sound pictures have driven sound on disk pictures from the market (defendants' witness Hammond, Vol. I, p. 365; Joy, Vol. I, bottom p. 230). Vol. II, p. 1045

25. As far as this record shows the patentees were the first in the world to demonstrate by public exhibitions, either sound on film or sound on film sound pictures, which they did in 1922 with one of their machines Vol. II, p. 1045

according to Figs. 3-6 of the patent (Vol. III, pp. 2-3) (Vol. I, pp. 81-2; 103-5; top 314).

Vol. II, p. 1046 26. Defendants have not proved that a single sound on *film* machine was ever used outside of a private laboratory even without accompanying pictures, prior to the patentees' first public demonstration in 1922, of sound on film sound pictures, and such laboratory devices were not with accompanying pictures. (See ref.'s re findings 25, 27.)

Vol. II, p. 1046 27. As to these laboratory uses (Ruhmer, Story and Hoxie) the first two were but crude efforts which were abandoned. Hoxie's first machine, even if it could be held to be earlier than the patentees' date of March 24, 1921, admittedly did not give uniformity of speed and was unsatisfactory; and even if it could be held that the alleged use of a flywheel on the film sprocket shaft in that machine had been proven, it was admittedly promptly abandoned for the use of a ball governor speed control device. (As to Ruhmer, Vol. I, p. 82. As to Story see his testimony at Vol. I, pp. 508; mid. 519; 509; 519; bottom 522; 521; 523; 510. As to Hoxie see citations as to findings 43, 44 and 48, infra.)

Vol. II, p. 1046 28. Defendants have not proved that a single sound on film machine or sound on film sound picture machine was ever put out prior to this trial utilizing a *stylus* for recording or reproducing the sound on *film*.

Vol. II, p. 1046 29. R. C. A.'s subsidiary—R. C. A. Photophone, Inc.—through whom it puts out its sound picture machines, was not incorporated until September, 1927, and so far as shown on this record, the first sound on film machine it put out was on October 28th, 1928 (a PS1 machine diagrams, Vol. III, pp. 327-9) and the first PS16 machine diagrams, Vol. III, pages 330-2, was on December 22nd, 1929 (Vol. II, pp. 846-8).

30. Early in 1931 after plaintiffs threatened suit against R. C. A., the latter offered to take a license under the patent if one could be secured upon reasonable terms. (See Pltf.s' Ex. 13, letters of January 31, 1931, and February 26, 1931, Vol. III, pp. 319, 321. See Conclusion of Law 20.) Vol. II, p. 1046

31. That on this record, as late as August, 1926, the only sound picture machine being publicly demonstrated in this country was a sound on *disk* machine put out by Western Electric Co. in a Warner Bros.' Theatre in New York City; that the witness Joy, after being given demonstrations of the Tri-Ergon machine in Berlin in 1926, advised William Fox to take an option on the American patents of the Tri-Ergon Co.; that pursuant to this option, Dr. Engl brought one of this Tri-Ergon sound on film sound picture machines over here in December, 1926, which was demonstrated with films recorded in Germany and with films recorded over here; that at that time the Fox-Case Co. had already signed a license with Western Electric, who were using *disk* records for the sound; that in view of this relationship between Fox-Case and Western Electric, the latter was given full access to the Tri-Ergon machine and demonstrations thereof, and Engl's services were made available in discussing the entire problems involved; that Fox exercised his option for the Tri-Ergon American patents, and Western Electric started in to experiment with and test out sound on film sound picture machines at the Fox studios for several months; that the first sound on film sound picture installation made by Western Electric was in July, 1927, at the Roxy Theatre, about 7 months after Engl's machine arrived here; and nineteen others by October of that year; that as late as May, 1927, at the meeting of the Soc. of M. P. Engineers the only apparatus exhibited there by Western Electric was sound on *disk* sound picture apparatus. (Engl, Vol. I, pp. 116-7; 126-7; Joy, Vol. I, pp. 223-233; 242-3; 245, XQ188.) Vol. II, p. 1047

Vol. II, p. 1048 32. As to the seven claims in suit, they are each directed and limited to an apparatus wherein or methods whereby sound is translated by light to or from a film strip (9, 13, 18 and 19 as granted, and claims 5, 7 and 17 by disclaimer). Claims 5, 7, 13 and 17 are apparatus claims and each is for a combination of two or more of the features set forth in Finding No. 5, supra. The remaining claims, 9, 18 and 19, are method claims and each is for a method including two or more of said features. The claims are not merely for the use of a flywheel in a sound head. (See claims with disclaimer.) (Vol. III, pp. 8-10; 227-8.)

Vol. II, p. 1048 33. Claim 7, which involves the spring drive, does not purport to claim broadly a spring drive between any driving and driven parts, or to claim a spring drive between a gramophone cylinder and its driving gear, but it is for a particular combination in a sound on film sound head in which the spring drive is included as one of the elements, with the flywheel, to produce, in combination with the others, a useful and valuable result. (See claim.) (Vol. III, p. 8.)

Vol. II, p. 1048 34. Claim 13, which includes the photoelectric cell, does not purport to claim broadly the use of a photoelectric cell for reproducing sound, but it is a claim for a particular combination in a sound on film sound head in which the photoelectric cell is included as one of several elements, to produce in combination with the others, a useful and valuable result. (See claim.) (Vol. III, p. 9.)

Vol. II, p. 1048 35. Defendants' PS1 machine (diagrams, Vol. III, pp. 327-9) embodies the invention of claims 5, 7, 9, 13, 18 and 19 as charged. (See claims as qualified by disclaimer. Ballard explains this machine, Vol. I, pp. 278-284, in connection with charts, Pltf.s' Exs. 15A, B and C, Vol. III, pp. 327-9; see also actual machine Deft.s' Ex. 76. The claims were applied by Ballard element by

element, to said machine; see Vol. I, pp. 295-303. Defendants produced no testimony contradicting or questioning Ballard's testimony on this point, nor showed any differences in the construction or functioning of the machine which would differentiate it from the invention of said claims. There seems to be no dispute on the record that if the patent is valid these claims are infringed.)

36. Defendants' PS16 machine (diagrams, Vol. III, pp. 330-2) embodies the invention of claims 9, 13, 17, 18 and 19 as charged. (See claims as qualified by disclaimer. Ballard explains this machine, Vol. I, pp. 304-308, in connection with charts, Pltf.s' Exs. 15D, E and F, Vol. III, pp. 330-2; also actual machine, Deft.'s Ex. 77. The claims applied by Ballard element by element, to said machine; see Vol. I, pp. 308-313. Defendants produced no testimony contradicting or questioning Ballard's testimony on this point, or showed any differences in the construction or functioning of the machine which would differentiate it from the invention of said claims. There seems to be no dispute on the record that if the patent is valid these claims are infringed.) Vol. II, p. 1049

37. Motion picture machines are different in construction and function from sound heads and involve different problems. Flywheels used in connection with the intermittent rotating sprocket of motion picture machines do not perform the same function as in the patent in suit, and in defendants' sound heads. Uniformity of speed of the film in motion picture projectors is not important even if it was not an intermittent motion. The flywheel is not on the film sprocket but on a shaft geared to it through intermittent gearing. The purpose of the flywheel is to carry this intermittent motion gear over the dead center and prevent its being locked at that point so as to avoid irregular strains on the *driving* mechanism by avoiding a jerky motion and heavy strains which the Vol. II, p. 1049

intermittent motion would cause on the driving mechanism if the flywheel were absent. The film motion remains an intermittent one and not one of constant or uniform speed. (Engl, Vol. I, pp. 158-160; 202—top 204; Kindlemann, Vol. I, pp. 324-5; Ballard, Vol. I, pp. bottom 283-4; 316; Vol. II, pp. 882-3; 906, Qs774, 778; Vol. I, p. 475.)

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38. A flywheel in a continuous movement motion picture machine is also for a different purpose than that of the patent in suit and of defendants' machine, i. e., it is to prevent strains on the *driving* mechanism. Uniformity of speed is not important in such a machine as the eye cannot detect substantial variations in the speed. (Ballard, Vol. II, pp. 905-7; Vol. I, p. 316; Engl, Vol. I, p. 159, XQ486; Vol. I, p. 160, XQ488; G. E. Co.'s Hoxie and Heisler pats., Pltf.s' Phys. Ex. 39 at p. 24; Ex. 49, Vol. III, p. 474, lines 102, etc.)

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39. Centrifugally actuated speed governors such for example as flyball governors, do not act like flywheels and they produce no appreciable flywheel effect. "A flywheel is a device the inertia of which is constant". The governors have a relatively low, variable inertia and because of this they may introduce oscillations; they did in the two Hoxie machines Defendants' Exhibits 43 and 45, and the results were not satisfactory. "The more rapid the speed fluctuations the more effective the flywheel will be and the less effective will a flyball governor be." Neither plaintiffs nor defendants use the ball governor in the sound head. (Engl, Vol. I, pp. 175-7; 205; Kindlemann, Vol. I, p. 328; Steiner, Vol. I, pp. 542; 548; Ballard, Vol. II, pp. 940-1.)

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40. Defendants contend that Hoxie operated his first laboratory sound on film machine with flywheel speed control to make a sound record (Deft.s' Ex. 51) as early as March 8, 1921. This date is only sixteen days ahead

of the patentees' effective date of March 24, 1921 (disregarding the Vogt, et al. date of February, 1921 in finding 41 and the Berlin Treaty, as affecting Vogt, et al. German application of May 23, 1920, for German patent 387,058, Pltf.s' Ex. 3, Vol. III, pp. 235-41). The actual constructural features of this Hoxie first machine as to its embodying a flywheel on the film sprocket for speed control and certain other features, rests upon the oral testimony of Hoxie and two mechanics as to their recollection over a period of more than twelve years. They have not been identified with the subject matter for several years and their memory is shown to be unreliable or poor. No notebooks or records with respect to the construction or operation of this first machine were produced. The only alleged part of the original machine presented is the box (now a part of a different machine, Deft.s' Ex. 43) with a part of the film track or means for guiding the film. The alleged film sprocket and flywheel are not there. It is admitted that the machine was reconstructed in July or August, 1921, and oral testimony is relied upon to show that it embodied flywheel speed control when the sound record is alleged to have been made on it, March 8, 1921. The sound record itself does not prove the construction of the machine upon which it was made.

When the dates are so close and the elapsed time so short such oral testimony is insufficient to establish the completion and the construction of said machine prior to March 24, 1921. (Hoxie, Vol. I, pp. top 616; 620; mid. 622; Steiner, Vol. I, pp. mid. 536; bottom 541-2; 545; Tschopp, Vol. I, pp. 590; 593-4.)

41. Engl testified with respect to one of the Tri-Ergon laboratory notebooks with entries, sketches and film records therein, that the patentees were experimenting with apparatus for recording sound on film prior to February, 1921, and that by February 10th they had built and were using a machine for recording tone frequencies Vol. II, p. 1052

on film, such machine being substantially along the lines of Fig. 1 of the patent in suit. Diagrammatic sketches of the apparatus and dated pieces of the original records appear in the notebook and are here in evidence (Engl, Vol. I, pp. 94-97; Vol. II, pp. 955-7; Pltf.s' Phys. Exs. 79, etc.). I cannot accept the testimony to establish Hoxie's date as prior to March 24, 1921, without accepting the above testimony of Engl establishing the patentee's date as prior to Hoxie's alleged date of March 8th, 1921.

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42. The Hoxie sound record, Exhibit 51, has at one end of it as a part of the sound recording, the date of March 8, 1921, but the film shows that it has two splices in it near this end. The film also has a date of March 9, 1921 printed on it in ink but the party who is said to have printed that date on the film was not called nor was his failure to testify explained. (See film, Deft.s' Ex. 51; Ballard, Vol. II, p. 740; Hoxie, Vol. I, pp. top 605; 608.)

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43. According to defendants' witnesses, the first Hoxie machine is said to have been built with a flywheel and handle, to serve as a hand crank for the machine, but they could not get "any even speed" with the machine; that it was then changed to a motor drive flywheel but this did not give satisfactory results so the machine was further changed by removing the flywheel and substituting a "gear and ball governor" which it is said was better than the flywheel, but that this also did not give satisfactory results, as the governor was "forever unbalanced" and introduced vibrations. This first machine, therefore, did not give satisfactory speed control in any of its alleged forms, and if it ever had a flywheel for the purpose of speed control it was a failure and was promptly abandoned for the said gear and ball governor control. (Steiner, Vol. I, p. 544; Tschopp, Vol. I, p. 593; Steiner, Vol. I, pp. 545; bottom 541; 542; 540, Q57; bottom 548-9.)

44. The speed of this first Hoxie machine when it embodied the gear and flyball governor, was not regulated or controlled by flywheel effect but the ball-governor brake was the controlling effect, the alleged flywheel—a gear (used with the ball governor)—being totally insignificant in the speed control; and was prevented by the governor-actuated brake from exercising even that insignificant effect. (Steiner, Vol. I, p. 549, XQ202; Ballard, Vol. II, pp. 941-4.) Vol. II, p. 1053

45. Defendants' testimony is to the effect that the gear and ball governor finally put on the Hoxie first machine was the same as that now on the Hoxie second machine except that a flyball governor was used instead of the disk governor now on the second machine. The gear on this second machine is made from thin brass stock of approximately 5/16 of an inch thick with the central part turned down to about ⅛ of an inch (removing this weight) leaving it with just about enough strength to support and drive the gear and pulley at the periphery of it. Such construction negatives any idea of the intended use of this gear as a flywheel and its momentum effect on the speed is in fact insignificant. (Vol. I, pp. 542; mid. 599; Ballard, Vol. II, pp. 941-4; see refs. to finding 44.) Vol. II, p. 1053

46. That if the Hoxie first machine ever embodied the feature of flywheel speed control before the gear and ball governor were put on, it was a temporary and unappreciated use since the flywheel is said to have been put in the machine for other reasons, i. e., because it was easier to take a flywheel and put a handle on it than to make a crank handle which the witness Steiner was instructed to put on the machine and also because the flywheel he had available already had a pulley secured to it for driving the takeup reel of the machine. (Vol. I, p. 544.) Vol. II, p. 1054

Vol. II, p. 1054 47. That even as to the insignificant flywheel effect of the thin brass gear finally used on the first machine and used in the second machine, it appears from defendants' testimony that this brass wheel was not put on with any idea of flywheel effect but to support the gear and pulley carried at its rim. (Steiner, Vol. I, p. 547.)

Vol. II, p. 1054 48. As to the second Hoxie machine defendants' witnesses contend that it was completed in its first form as early as the middle of April, 1921, but they admit that due to its unsatisfactory operation a new governor was substituted for the ball governor in July or August, 1921. These dates are all later than the effective date of the patent in suit. The first construction of this machine alleged to be as of April, 1921, was admittedly unsatisfactory and as to both constructions, the speed control was by governor brake action and not by flywheel effect. (Vol. I, pp. 540, Q57; bottom 548-9; mid. 545; 542; and citations of Finding 43.)

Vol. II, p. 1055 49. According to the testimony of defendants' witnesses as to Hoxie's first machine, and as shown by the construction of the Hoxie second machine, Defendants' Exhibit 45, the film was pulled by the film sprocket directly from the delivery reel over a guide roller past the translation point, and without any intervening loop, and the film was pulled from the film sprocket to the rewind reel without a loop. Such a construction produces a jerky motion on the film which will prevent uniformity of speed at the translation point. (Waterman, Vol. II, pp. mid. 678-9; mid. 720-1; Ballard, Vol. II, pp. top 896; 885; 889 and at other places in the record.)

Vol. II, p. 1055 50. The Hoxie sound record, Defendants' Exhibit 51, was merely a speech record and not of a character to demonstrate speed control, but even so and by whatever machine it was recorded it was poor and showed evidence of having been stopped and started during the

recording. Hoxie testified that he also made music records and he believed that the General Electric Co. had them, but none was produced for test. (Ballard, Vol. II, pp. mid. 740; bottom 858; Hoxie, Vol. I, p. top 617.)

51. In view of the foregoing findings Nos. 40 and 42 to 49, Hoxie cannot be accepted as a prior inventor to the patentees of even such features of his machine as defendants' witnesses allege were embodied in his machine. Vol. II, p. 1055

52. Neither Hoxie's first or second machines were ever used except experimentally in the General Electric Company's laboratory and the company has never put out any commercial reproducer for sound on film. (Hoxie, Vol. I, pp. mid. 619; bottom 620-1.) Vol. II, p. 1055

53. According to the testimony of defendants' witnesses as to the first Hoxie machine and as shown by the construction of the Hoxie second machine, Defendants' Exhibit 45, neither machine embodied any of the following features of the patent in suit—the arcuate bending of the film at the translation point; the spring drive arrangement for the flywheel; the optical slit; and the idea of a smooth film roller around a substantial portion of which the film is wrapped to drive the flywheel, in combination with a sprocket for feeding the film through the sound head, as for example in Fig. 2 of the patent in suit and in defendants' PS16 machine. (See Steiner's testimony as to the construction of Hoxie's first machine, supra, and see second machine, Defendants' Exhibit 45.) Vol. II, p. 1056

54. The Pedersen British Patent No. 115,942 (Vol. V, p. 1349) suggests the recording of sound by a spot of light (not a line of light) in conjunction with the taking of motion pictures and the reproducing of sound in conjunction with the projection of motion pictures, by form- Vol. II, p. 1056

ing a metal matrix of the wavy sound line sound record thus produced; pressing this metal matrix into the motion picture film and using a stylus for reproducing. Pedersen states in his patent at page 2, lines 29-32, that sound is exceedingly sensitive to speed variations, and in order to obviate variations in speed during the producing and reproducing operations he provides particularly large flywheels, but he does not show or describe any suggestion as to where the flywheel shall be located in his combined sound picture machine; much less does he teach that it should be secured to the film feeding sprocket in the sound head at or adjacent the translation point. But he does state that his sound may be recorded "on the delivery drum or feed reel" (p. 2, lines 23-4) and that the sound may be reproduced by the needle located "on the winding drum or uniformly rotating transmitting drum" (line 25). As plaintiffs' witness Ballard points out these parts at which it is said the sound is to be translated, are all well known parts of a motion picture machine. It is apparent that a delivery drum or feed reel must always rotate with a considerable variation in speed as the film is being wound from it because of the changing diameter of the roll of film coiled upon it (Vol. II, p. mid. 905). Without this variation in speed the reel would not properly feed the film to the film transmitting sprocket at the picture gate, but would over- or under-feed it; and the same is true with the "winding drum". If a flywheel were to be put on the shaft of either of these devices where Pedersen says his sound is to be translated, it would interfere with, if not prevent the reel from functioning as it is intended to function and must function—with a continuously varying speed—in order to have the machine operate. It is therefore apparent that Pedersen did not intend to put the flywheel on the shaft of any of these devices, and if his patent teaches this it teaches something inoperative. It cannot be presumed that he teaches the use of the flywheel on the shaft of a sprocket or transmitting drum, if he

does not teach the use of it on the shaft of the reels where it should not be put.

The patent is a vague foreign patent and I agree with plaintiffs' expert that it does not teach the putting of the flywheel on the shaft of any of these devices at or adjacent to the translation point.

Defendants' and plaintiffs' experts testified to the jerky motion caused by rewind and takeup reels on a film at the translation point, and to the objection of hold back sprockets for the same reason, but these are the devices at which Pedersen proposes to translate his sound which would result in a jerky motion.

I agree with plaintiffs' expert that the patent shows many crude and inoperative features which would give wholly unacceptable sound reproduction. Defendants constructed and demonstrated at the trial many models alleged to represent various machines, but they did not attempt to demonstrate a model representing this patent although they have stressed this patent.

I further agree with plaintiffs' expert that defendants' sketch (Deft.s' Ex. 148, Vol. V, p. 1715) allegedly representing Pedersen's disclosure, is not justified by the Pedersen disclosure and Pedersen does not teach what it shows.

The Pedersen patent does not disclose the subject matter of the claims in suit and has not contributed anything of value to the practical art of sound on film recording or reproducing.

It also appears from the record that in the German nullity proceedings brought against each of the German patents directed to flywheel speed control of the film, this Pedersen patent was cited and the tribunals held that the patent did not disclose where the flywheel should be located in the Pedersen machine. For example, see in the case of Erpi v. Tri-Ergon (Deft.s' Phys. Ex. 99, translation of decision, p. 11), it was held that the Pedersen patent "contains neither in the specification nor in the drawings any suggestion as to the place where the

flywheels * * * are to be disposed", pointing out that there may be various places where the flywheel could be put which would not produce uniformity of motion at the place of control. (See Pedersen Pat., Vol. V, p. 1349; Ballard, Vol. II, pp. 884-7; 917-8; top 896; 889 Qs740-1; Waterman, Vol. II, pp. mid. 678-9; mid. 720-1.)

Vol. II, p. 1059

55. Defendants set up six patents of one Cawley, of Pittston, Pa., to wit, Nos. 1,710,677, 1,825,438, 1,825,439, 1,825,440, 1,825,441 and 1,878,577. It does not appear from the record that Cawley was ever engaged in the practical or actual development of sound on film work. Of these six patents only one of them (No. 1,825,441) was filed prior to the effective date of the patent in suit. There is a seventh Cawley patent, No. 1,594,662, not set up in the answer but introduced by plaintiffs (application and patent, Pltf.s' Ex. 62) filed in 1919. Defendants, therefore, are limited to the disclosures of the applications of these last two patents (Deft.s' Ex. 95, Vol. V, p. 1517 and Pltf.s' Ex. 62; also Deft.s' Ex. 94, Vol. V, p. 1495) in support of their contention that Cawley is a prior inventor to the patentees of the patent in suit, of any alleged common subject matter.

Neither of these two patents nor their applications were, however, referred to by defendants' expert Waterman. He only referred to Cawley patents 1,878,577 and 1,825,438 (Vol. II, pp. 661-2), but the first of these was not filed until April 23, 1929, as an alleged division of one of the earlier applications, and the second one was not filed until September 16, 1929, as an alleged division of another of the said earlier ones.

Some of these six patents were filed some months after the grant of the patent in suit, and others, including the one set up which was filed early enough to be considered (No. 1,825,441) was still pending when the patent in suit issued, and was not granted until September, 1931.

I find no statement in this last patent (1,825,441) or the application therefor (Deft.s' Ex. 95, Vol. V, p. 1517)

or in the only other application that is early enough (Pltf.s' Ex. 62; also Deft.s' Ex. 94, Vol. V, p. 1495), or in the patent that issued thereon (No. 1,594,662, Pltf.s' Phys. Ex. 62) with respect to obtaining uniform speed by a rotating member of considerable mass or by flywheel effect or the like. It appears that all statements directed to these ideas were introduced after the grant of the patent in suit, which the application files show that Cawley had considered. It also appears that R. C. A. acquired some of these Cawley patents after the patent in suit issued (Pltf.s' Exs. 70-71, Vol. III, pp. 537, 541).

In one of the two applications filed early enough (Pltf.s' Ex. 62; also Deft.s' Ex. 94, Vol. V, p. 1495), the apparatus disclosed in one suggesting the recording of sound by stylus on a film. The stylus rests upon the film where it passes over and around a portion of a 32-tooth size motion picture sprocket. There was no suggestion of any heavy weighty mass or flywheel effect resulting from the use of this sprocket to control the speed of the film, and the size of a 32-tooth sprocket negatives any such idea. A sprocket of this size in evidence (Pltf.s' Ex. 74) measures less than 1⅞ inches in diameter. There are sprockets here in evidence from 16-tooth to 54-tooth for feeding film in sound heads (Plaintiffs' and defendants' machines and Deft.s' Ex. 79; photo, Deft.s' Ex. 79A, Vol. V, p. 1429), but in all cases they have a flywheel secured to their shaft to give the desired speed control. The idea of flywheel control from Cawley's 32-tooth sprocket is further negatived by the fact that it is described and shown as having a substantial thickness of some relatively light material at its periphery where weight is most important for flywheel effect. In April, 1929 Cawley filed another application (Pltf.s' Ex. 61; See Fig. 1 of Cawley, 1,878,577, Vol. V, p. 1296) showing this sprocket as a 16-tooth size with the light material at the rim, and he no longer called it a "large" sprocket.

No importance can attach to the statement in this Cawley application (Ex. 62; also Deft.s' Ex. 94) that it is highly desirable that the film should be held perfectly rigid while moving at an absolutely uniform rate of speed, because in another Cawley patent (No. 1,420,304 filed the same year, 1919; Pltf.s' Phys. Ex. 64; p. 3, line 50) Cawley states "An absolutely uniform speed is necessary for sound recording, and for this reason the camera should be driven by some form of motor".

The original Cawley application (Pltf.s' Ex. 62; also Deft.s' Ex. 94) does not disclose the use of a flywheel or heavy rotating mass at or adjacent the translation point for obtaining uniform speed, and any momentum effect for that purpose resulting from the use of his 32-tooth sprocket is wholly unappreciable. This application discloses no recording of sound by light nor various other features which the claims of the patent in suit call for in combination with it. (See application, Pltf.s' Ex. 62, and application, Deft.s' Exs. 94, 95, Vol. V, pp. 1495, 1517, and files of the other Cawley applications mentioned, Pltf.s' Exs. 61 to 71; also Ballard, Vol. II, pp. bottom 947-953.)

As to the other Cawley application filed early enough (Deft.s' Ex. 95, Vol. V, p. 1517), defendants' expert, Waterman, did not refer to this either; he did refer to Cawley patent 1,825,438 (Vol. V, p. 1254), not filed until September, 1929 (after the patent in suit issued), and as an alleged division of the earlier application, but even as to this he merely briefly mentions it in about sixteen lines (Vol. II, pp. bottom 661-2), and does not undertake to explain how a machine of this construction could operatively function. Plaintiffs' expert, Ballard, discusses said original application (Deft.s' Ex. 95), and the patent that issued thereon (No. 1,825,441, Vol V, p. 1290), pointing out that the film moves in one direction over a sprocket or wheel, and that an arm pivoted coaxial with the wheel, revolves in the opposite direction carrying either a stylus for scratching a record longitudinally

of the film or carrying an incandescent lamp for the purpose of recording the sound. The arm is rotated through a chain of gears. There is no suggestion of any flywheel effect being given the film for speed control by the sprocket or wheel shown, and even if it were possible to produce any flywheel effect on the film by the construction disclosed, there would be no flywheel speed control of the revolving sound recording arm. Speed control of the film without speed control of the arm carrying the stylus or lamp would not give uniform speed control to the sound record, for it is the *relative* motion of the stylus and film that governs the recording. There is no fixed translation point in the device and no provision is shown for making an operative sound record by the revolving incandescent lamp, and as to the stylus recording, this has to engage and disengage the record at intervals during each rotation of the arm, and plaintiffs' expert states that such intermittent contacting of the stylus with the film would produce loud noise on the sound record occurring at rapid intervals which would sound like a machine gun and overpower any sound reproduction. He also criticized the patent on various other features, such as the inoperative arrangement of the selenium cell, and I agree with his undisputed testimony that the Cawley devices shown in said original application (Deft.s' Ex. 95) and in the Cawley patent 1,825,441 based thereon, and in the other Cawley patents alleged to be based thereon, including patent 1,825,438, mentioned by Waterman, are completely inoperative. Defendants did not attempt to demonstrate any Cawley model among the many other devices demonstrated by them.

Cawley is not a prior inventor of the subject matter of the claims at issue. (See Deft.s' Ex. 95, Vol. V, p. 1517; and Cawley patents mentioned; Ballard, Vol. II, pp. 950-3.)

Vol. II, p. 1062

56. The Dragoumis patent (Vol. V, p. 1379) is a foreign patent. It shows a machine having a loop of celluloid strip passing over a drum upon which it is proposed to record sound in a series of loops by having the stylus carriage move transversely of the strip. This carriage is moved by a feed screw and it is stated that the strip may be advanced at a much reduced speed in order to get a greater amount of sound on the loop, for which purpose the record may be made on both sides of the loop. The sound is not recorded by light on a photographic film. As plaintiffs' expert points out, the stylus carriage is moved by a feed screw geared by a train of gears to the shaft carrying the film feeding drum, and there is another train of gears connected to the feed screw shaft for operating an indicator; all of this mechanism causing heavy irregular loads upon the shaft of the film drum, and it is impossible with this apparatus to obtain uniformity of speed of the drum suitable for sound on film, since this mechanism involves inherent irregular loads on the shaft. Defendants' expert admits that the patent does not mention a flywheel much less the effect of one in the control of speed; and it does not refer to uniformity of speed.

The patent shows a spoked pulley on the shaft with the film drum, which is not mentioned in the specification, much less is any suggestion given as to its being a heavy pulley, or of what material it is made. For all that appears in the patent, it may be made of aluminum, wood or fibre. In answer to an inquiry in defendants' reply brief, as to whether plaintiffs ever saw a wooden wheel with spokes shaped like Dragoumis' pulley, one was exhibited to the Court at the argument, said to have been a part of Ruhmer's original machine for recording sound on film, but this is not of record. While in some relatively large flywheels such as those used in steam engines and the like, spokes are used; a spoked pulley used in this type of apparatus is indicative of the absence of any idea of flywheel effect.

Defendants demonstrated an alleged model of this machine using a brass pulley on the roller shaft, but omitted from it all the above stated train of gears; feed screw, carriage and indicator, which would produce irregular loads on the pulley shaft. They admittedly did not use the hill-and-dale type of record of Dragoumis, but a laterally cut record admittedly specially gotten up for the demonstration, and admittedly such a record had never been produced before by the laboratory which produced said record for the demonstration, and admittedly a modern electric pickup system was used for the reproduction in lieu of the feed screw carriage and stylus of Dragoumis, and of a type which had only existed for the last two or three years, made by the Bell Laboratories under instructions to make the best. Such a pickup gives a minimum of irregular loads on the film drum shaft.

The model demonstrated was clearly not made or operated in accordance with the Dragoumis patent and the results obtained cannot be accepted as results obtainable from Dragoumis' teachings. Furthermore, the model was only demonstrated with speech and spirited music which, as plaintiffs' expert points out, would give little or no indication of speed fluctuations.

I agree with plaintiffs' expert that the Dragoumis patent does not teach anything with reference to the patent in suit. It does not disclose the idea of speed control by a flywheel or heavy rotating mass, and it does not disclose the subject matter of any of the claims at issue. It does disclose arcuate bending of the celluloid strip where sound is recorded by stylus, but as pointed out by plaintiffs' expert, the various problems solved by the arcuate bending of the film in the patent in suit are special to the recording and reproducing of sound by light. (See Dragoumis patent, Vol. V, p. 1379; Ballard, Vol. II, pp. bottom 754-757; 892-3; 739; Waterman, Vol. II, p. 657; Vol. I, pp. 579-80; Vol. II, pp. bottom 703; 709; mid. 710-11.)

The Dragoumis patent was a reference in the file of the patent in suit (Pltf.s' Ex. 1) and it was set up in the various German nullity proceedings against the Vogt, et al. German patents, and was thrown out for lack of disclosure. In one of these proceedings (Deft.s' Phys. Ex. 99, Erpi v. Tri-Ergon, translation of decision, p. 10) it is stated:

> "In French patent 472,467" (Dragoumis) "the spoke wheel of Fig. 1 is the main driving wheel of the equipment of which nothing is said that it should have a large mass. In that it is shown as a spoke wheel its mass of itself is also small, and it would only act as a flywheel if it were made of a particularly heavy substance. But nothing is contained in the patent specification as to this."

(See also Deft.s' Phys. Ex. 103, E. R. P. I. v. Tri-Ergon, translation of decision, p. 5.)

Vol. II, p. 1065

57. The Bell & Tainter patent No. 341,214 (Vol. IV, p. 770), shows two or three types of machines. The particular form here relied upon by defendants is shown in Figs. 18 and 19. In this form it is proposed to record sound upon "a wax-coated strip R of paper" which passes directly from a delivery reel U over a part of the circumference of a disk S on a shaft P, thence directly to a rewind reel T. Both of these reels are belt driven from the shaft upon which the said disk S is mounted, and four friction clutches are provided between the reels and their driving pulleys. A stylus is provided resting upon the paper strip at the periphery of the disk S for recording the sound. The shaft P carrying disk S is also provided with a disk Q which is driven by a tangential friction drive in the form of a rubber roller G rotating in contact with the disk Q and driven by a hand cranked flywheel 8.

As plaintiffs' expert points out, the flywheel is not on the shaft with the disk S but is on the driving shaft with the interposed tangential friction drive above mentioned, which would result in slippage and relative rotation between the flywheel and the disk S feeding the film, and thus will be prevented from giving uniform speed to the disk. As he also points out, the Jamieson British patent No. 2,814 (Deft.s' Ex. 74, Vol. V, p. 1323) shows a tangential friction disk drive for the purpose of permitting slippage between the frictionally engaged parts. Uniformity of speed of the strip of paper R would also be prevented because of the direct pulling of the strip by the drum from one rewind reel past the translation point, and the pulling of it by the other rewind reel from the translation point, which both experts agree would cause a jerky motion at the translation point in a sound recording or reproducing machine (Waterman, Vol. II, pp. 678-9; mid. 720). As plaintiffs' expert points out, the irregularities in speed would be accentuated by the friction clutches above mentioned which would add considerably to the irregular loads being placed upon the shaft P by the reels; and the arrangement disclosed would be bound to create irregularities in speed of the strip.

The flywheel is not on the drum shaft at the translation point. The device disclosed cannot produce uniformity of speed suitable for sound recording on a film and the patent does not disclose the subject matter of any of the claims at issue.

Defendants produced an alleged model of this device but they did not demonstrate its operation to the Court or to plaintiffs' representatives. (See patent and Ballard, Vol. II, pp. bottom 894-896.)

58. The Trowbridge patent (Vol. V, p. 1193) was filed earlier than, but did not issue until after the filing of the patent in suit. It is not a device for sound recording or reproducing. The patent is entitled "Recording Indicator". The device is described as used for the Vol. II, p. 1066

"investigation of the gas pressures in a high speed internal combustion engine". Defendants' witness, Duryea, states that it was used "to take many records of the explosion pressures in gasoline engines". Briefly stated, it is a machine which records the *rate* of changes in pressure for example in such devices as a gas engine, upon a strip of paper. Transverse parallel lines are also recorded on the strip at definite time intervals for measuring the rate of change of the pressures. The strip is fed by two smooth surface friction pinch rollers past the recording point, whereupon the strip of paper only a few inches long on which the record is made, is cut off and automatically passed through a developing compartment constituting a part of the machine. All of this mechanism is driven from the same driving shaft. The device is a combined pressure recorder and developer.

Defendants' witness states that the short strip is passed through the recording compartment in about one second. The patent is cited because it is contended that a flywheel shown and described is on the shaft of one of the smooth rollers. In the drawings of the patent (Fig. 14) the flywheel does not appear to be on the shaft of the roller because the two are out of alignment, but in the model produced by the witness the flywheel was shown on this shaft. The operation of the model was not demonstrated to the Court. As plaintiffs' expert points out (and defendants' witness agrees with him), the record made by the machine is not a true record of pressure, vibration or sound, but is merely a record of the rate of change in pressure. Plaintiffs' expert also states that if one sought to reproduce such a record he would get an absolutely unintelligible result; and such a record cannot be reproduced into sound regardless of other difficulties with the machine. Defendants' witness admitted that with the machine he only got an approximately uniform speed; that uniformity of speed was not necessary for the proper intended use of the ap-

paratus; that the time interval in the pressure curve would be correctly shown "regardless of the variations in speed of the apparatus". He also produced pressure records in his origial notebook, made by the machine, and admitted that they showed variations in speed. The "characteristic curve" of the device as shown in the notebook, showed oscillations. Plaintiffs' expert testified that the records presented in the notebook showed that they had not moved through the machine at anything like constant or uniform speed, and that the arrangement and construction of the apparatus was such that uniformity of speed could not be obtained.

The Trowbridge patent is non-analogous art; the device did not produce, and appears to be incapable of producing uniformity of speed of the record strip, and it does not teach anything with respect to the problems solved by the invention of the patent in suit, and does not meet any of the claims at issue. (See Ballard, Vol. II, pp. bottom 889-91; Duryea, Vol. I, pp. 527; bottom 531-2; bottom 501; 528-9; 533-4.)

59. The Ries patents (Vol. V, pp. 1215, 1231) show a sound on film sound picture machine, but as plaintiffs' expert points out,—and his testimony is not contradicted—, the patents do not show or suggest a flywheel or speed control by one. The film is pulled from the translation point by a rewind reel which will not give uniform speed. The patents do not show a photoelectric cell or an optical slit or the arcuate bending of the film at the translation point, but have a mechanical slit and a selenium cell. The patents do not disclose the subject matter of any of the claims at issue. (See Ries patents; Ballard, Vol. II, pp. 887-9; bottom 891-2.) Vol. II, p. 1068

The original application for one of the patents was filed prior to the patent in suit but both patents were granted after the application date of the patent in suit.

Vol. II, p. 1069

60. As to the earlier cylinder and disk gramophone patents and devices of Edison and others; I agree with plaintiffs' expert that the application of flywheel control to the film as it passes through the sound head so that each successive length of the light flexible film as it passes the translation point, will have given to it the property of a weighty mass, to give uniform speed to the film, involves a distinctly different problem and is a different thing from these cylinder and disk gramophones where a cylinder or disk record is placed upon a mandrel or plate to rotate therewith, and which because of their weight or that of some added momentum device on the shaft, provide considerable momentum for equalizing irregularities in speed. Defendants' expert in discussing the patent in suit and defendants' machines, points out that "impulses coming from the picture projector or from splices in the film or from inequalities of gears or bad sprocket holes" will set up irregularities in speed. Obviously all of these features are not present in cylinder or disk gramophones and hence the problem of avoiding speed irregularities caused thereby and the means for avoiding it, are not present in such machines. Defendants' expert Hammond, who operated the old Edison gramophones, including the Kinetophone, and who has operated sound on film sound picture machines for several years, states that there is an entirely different condition existing in these sound on film machines, and admits that there is an entirely different problem in the two types of machines and that there are entirely different problems to meet. (Ballard, Vol. II, pp. 881-2; Hammond, Vol. I, pp. bottom 354-5; mid. 356; Waterman, Vol. I, p. 568.)

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61. As shown from the specification, the patent in suit was granted with the understanding, and with the acknowledgment in the specification, that such cylinder and disk gramophone devices were known.

In an opposition proceeding brought in the German Patent Office against one of the German patents directed

to the idea of application of flywheel speed control to linear sound carriers, some of these gramophone patents here relied upon were set up, including Edison No. 227,679 (Vol. IV, p. 739), the one chiefly stressed in this suit; but the German tribunal disregarded them as affecting the patent there, with the statement—

> "In that in the subject matter of the attacked patent there is involved an improvement in the drive of a *linear* sound record all of those patent specifications in which a linear sound record carrier is not used are of no interest, for in these the problem solved by the attacked patent is not present," etc. (See specification of patent in suit, p. 1, lines 13-28 [Vol. III, p. 5]; Deft.s' Phys. Ex. 99, Erpi v. Tri-Ergon Holding Co., et al., translation of decision, p. 10.)

62. Edison patent No. 227,679 of 1880 (Vol. IV, p. 739), Vol. II, p. 1070
appears to be the principal cylinder or disk gramophone patent relied upon by defendants. It shows a machine with a single shaft having hereon the cylinder mandrel, and at one end a flywheel with a crank handle; the shaft with its cylinder and flywheel are moved endwise through the bearings as the shaft rotates by a feed screw on the shaft. In this patent Edison mentions the desirability of great uniformity of speed, and states that to attain this he uses an abnormally heavy flywheel upon the shaft of the photograph. But this shaft is also the driving shaft and the flywheel is at the driving point. The patent does not teach the importance of having the flywheel directly on the shaft with the mandrel, as distinguished from having it on some other driving shaft if more than two were to be used in the machine; and Edison's subsequent patents, Nos. 386,974, 499,879 and 513,095 (Vol. IV, pp. 807; 825; 857), show that he himself did not understand from the disclosures of his first patent, the desirability or importance of having the flywheel on the shaft with the mandrel, as distinguished from

placing it at some other location such as on the driving motor shaft or in the driving motor.

In his second patent, No. 386,974, of 1888, he eliminates the flywheel from his horizontal mandrel shaft and locates it down in his driving motor on a vertical shaft, which is geared to the mandrel shaft by tangential bevel friction gearing, which of itself is subject to slippage with respect to the driven mandrel; and he provides a governor for controlling the speed. In his next patent, No. 499,879, of 1893, he again eliminates the flywheel from the horizontal mandrel shaft and builds his motor armature of considerable size to act as a flywheel, and places this on a vertical shaft belted to the mandrel shaft. In his next patent, No. 513,095, of 1894, he eliminates the flywheel entirely from all parts of his machine and utilizes centrifugal ball governors actuating a brake for controlling the speed of the machine.

The prior cylinder and disk gramophone patents and devices do not contain the subject matter of any of the claims at issue. (See said patents; Ballard, Vol. II, pp. 899-902.)

Vol. II, p. 1072

63. The Edison Kinetophone machine (Deft.s' Phys. Ex. 11, photo, Vol. IV, p. 643) without the connecting belts and synchronizer to his motion picture machine, was demonstrated with two old Edison records, one of which admittedly had only been used a few times and was in fairly good condition (Vol. I, p. mid. 383). As plaintiffs' expert points out, the records were not of a character to test speed constancy but the reproduction was poor. (Ballard, Vol. II, pp. 732-3.)

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64. As to the other demonstrations of the Edison Kinetophone (Deft.s' Phys. Ex. 11, photo, Vol. V, p. 1485) and Triumph machines (Deft.s' Phys. Ex. 31, photo with electric pickup as demonstrated, Vol. V, p. 1487), admittedly the machines were not demonstrated as constructed and intended to be operated. Admittedly it

the demonstrations the mechanical stylus with the feed screws, clamp nuts, and gearing for driving the same, were not used, but instead a modern electric playback pickup was used giving the very slightest pressure that would make a track, and wax records were used of a character which had to be kept in a refrigerator so that they might be played more than once.

As plaintiffs' expert points out, the omitted parts are inherent component parts of the machines and are sources of substantial friction and irregular loads on the mandrel shaft. He points out that the omission of this stylus mechanism would have a very large if not a controlling significance as regards uniformity or non-uniformity of sound reproduction; that the soft wax records used would be obliterated by the usual stylus pressure, and that the electric pickup used was a delicately balanced modern one exerting very little pressure on the records.

I agree with plaintiffs' expert that these demonstrations did not give an indication of how the machines as originally constructed and operated, would function either as to speed constancy or quality of reproduction. (Waterman, Vol. II, p. 701, XQs160-61; p. 703, XQ172; pp. 703-4; bottom 705; mid. 708-709; Ballard, Vol. II, pp. bottom 859-863; 745; mid. 761-2; 993, XQ1171.)

65. Defendants have cited no prior art, teaching or suggesting the advancing of the film through a sound head by a sprocket with the film contacting with a substantial portion of the periphery of a cylinder associated with a flywheel and located between the sprocket and the sound translation point; so that the record is advanced uniformly under the control of the flywheel, and the small irregularities due to the sprocket engagement with the film are effectively prevented by the cylinder from reaching the translation point. The relationship of these features as set forth in the combination of claim 17 is new and useful and is embodied in de- Vol. II, p. 1073.

fendants' PS16 apparatus (diagrams, Vol. III, pp. 320-2; Ballard, Vol. I, pp. 257-60; mid. 307-8; 310-11).

Vol. II, p. 1073

66. None of the prior art spring drive devices relates to sound on film sound heads (Holst, Vol. IV, p. 895; Amet, IV, 967; Jamieson, V, 1319; Constable, V, 1185; Galley, IV, 735; Royce, V, 1341; French Pat. 10,377, V, 1361); and none of them discloses the combination of claim 7 of the patent in suit, involving as one of its elements, a resilient connection located between a flywheel mounted on the shaft of a film engaging cylinder and a coaxial driving member for said shaft. The combination of claim 7 is new and useful and is embodied in defendants' PS1 apparatus (diagrams, Vol. III, pp. 327-9). (See said patents; Ballard, Vol. II, pp. bottom 745-7; 911; 908; 939.)

Vol. II, p. 1073

67. The German decision on the nullity proceeding against the German Patent of Addition No. 389,317, for the spring drive, holding that patent invalid, involved a different situation from that presented here with respect to claim 7 of the patent in suit, and is not a precedent for the situation here. In the German situation, sound head apparatus without the spring drive was the subject matter of the main German patent. The patent of addition showed only the driving member and flywheel with the spring connection. According to a German Supreme Court decision cited by defendants' expert on German law, it would appear that the subject matter of a German patent of addition to be valid, must disclose subject matter beyond that of the main patent, which *additional subject matter over that of the main patent,* must be of inventive character as compared with the state of the art to be considered, but not including the main patent as a part of the art. This is not the situation with respect to claim 7. In this country there is no main patent for a part of the invention covered by the claim; the patent in suit involves the whole sound head appara-

tus including the spring drive, and claim 7 is for a combination of elements of that apparatus including the spring drive as one of them. (See German patent of addition 389,317, Vol. V, p. 1549; Dr. Mueller, Vol. II, pp. 769-70; and authorities cited; Vol. II, p. 774, Qs47-8.)

68. The Terwilliger (Vol. IV, p. 1097) and Anderson (Vol. IV, p. 1081) patents showing a curved motion picture gate, do not meet claim 9 of the patent in suit, including the feature of flexing the film arcuately at the translation point of a sound head where the sound is recorded by light, and would not teach one to do this in a sound head. Plaintiffs' expert points out that it has been known for many years that picture film must be kept as flat as possible at the gate, for any departure from this would throw the picture out of focus on the screen, and that the curving of the film at the gate would throw the picture comletely out of focus on the screen. Defendants do not use a curved surface at their motion picture gate but do curve the film at the translation point in the sound head. (Ballard, Vol. II, p. 925.) Vol. II, p. 1074

69. The patents cited to show photoelectric cells (Compton [Vol. V, p. 1227], Kunz [V, 1161], Hull [IV, 687] and Langmuir [IV, 1127], some of which were not issued until after the patent in suit was filed) do not disclose or suggest the use of the photoelectric cell for sound recording, or that it is desirable for that purpose, much less do they disclose the combination of claim 13 of the patent in suit involving that feature as an element. (Ballard, Vol. II, pp. 936-9; Pltf.s' Ex. 10, Judge Adkins' Findings 21 and 23, Vol. III, pp. 288-9.) Vol. II, p. 1075

70. As to the main German patent No. 387,058 (Vol. V, p. 1544), the two forms of apparatus shown therein are different from each of the various forms shown in the patent in suit. Several features included in the com- Vol. II, p. 1075

binations of the claims at issue are not even disclosed in said German patent, such for example as the spring drive, the arcuate bending of the film at the translation point, and the special arrangement of the film feeding sprocket in combination with a cylinder over a substantial portion of the periphery of which the film is engaged between said sprocket and the translation point. In the German patent the film passes between two smooth tangentially engaging friction or pinch rollers in a straight line to and through the guides at the translation point. Only this kind of engagement is relied upon to cause the flywheel on one of these rollers to be driven by the film without slipping, to give the film the desired uniformity of speed of the flywheel.

That slipping will take place between the film and the flywheel roller in such an arrangement is shown from the construction of Fig. 2 of said German patent where there are two such sets of film engaging pinch rollers spaced apart and driven at different speeds to keep the film under tension; and defendants' expert admits that in this construction there must be some slippage between the film and one of the pairs of pinch rollers. (Vol. II, pp. 715-6, XQ249.)

Dr. Engl testifies that this German application was filed when they had the first crude idea about the importance of applying a flywheel, and that the application was filed without having tried out the feature, but they quickly decided that the construction would be of no use because it would not operate in the way it is shown in that patent, and that "it is impossible to keep the film by these means in a steady motion of constant speed which we desired" (Vol. I, pp. 118-9.)

Defendants built an alleged model (Deft.s' Ex. 78; Sketch, Pltf.s' Ex. 46, Vol. III, p. 447; photo, Deft.s' Ex. 78A, Vol. V, p. 1421) of Fig. 1 of the German patent to demonstrate its operation; but I agree with plaintiff's expert that the model as demonstrated to the Court has several features in it important to its operation, which

are not suggested or justified by the German patent. The operation of the model, therefore, did not establish the operativeness of the device of the German patent. (For comparison see Fig. 1 of the German patent, Vol. V, p. 1544, and sketch of defendants' model, Pltf.s' Ex. 46, Vol. III, p. 447.)

Plaintiffs' expert points out the roughness of the clamping plate at the gate in this model, which is pressed on the film with an inordinate heavy pressure of several pounds, and the condition of the surface of one of the pinch rollers which under the heavy pressure used on that roller, would damage the emulsion on the film. Upon examining the film which was run through the machine he points out scratches and abrasions on the film. He also points out the feature of swiveling the upper pinch roller, and that the model also embodies certain features for preventing the weaving and slipping of the film enunciated in an article published in 1930 by one Kellogg, an engineer of R. C. A.; for example, the roller around which the film is bent to change its direction, etc. (Pltf.s' Ex. 44, p. 653, at pp. 664-5; Vol. III, pp. 427-8) who was present throughout the trial.

It appears that after the demonstration to the Court, upon plaintiffs' request a demonstration was given by defendants reducing the spring pressure at the gate but keeping it strong enough to hold the plate in proper position, and with this change very pronounced irregularities in speed occurred such as to make the device entirely impossible from a commercial standpoint; that another change with regard to the feed sprocket was requested and made, and that in this "the result was terrible". Defendants have not disputed any of this testimony.

On the evidence before me I find that defendants' model embodies features from the Kellogg article necessary to its operation and not justified by the German patent, and that the apparatus of the first German patent is inoperative to produce uniformity of speed suitable

for sound on film recording and reproducing. (Ballard, Vol. II, pp. 748-751; 763; bottom 868-9; 870-3; 1003-4; 1023.)

Vol. II, p. 1077 71. Defendants have set up about seventy United States and foreign patents against the patent in suit, but although urged by plaintiffs (before and during the trial) to do so, they did not point out any one or more of them as an alleged anticipation of any of the claims at issue, unless it be Pedersen as argued in their brief; but the uncontradicted testimony is that Pedersen's apparatus is inoperative. (See citations to finding 54.)

Vol. II, p. 1077 72. That each of the features by which the claims in suit are qualified by disclaimer, was shown and described in the application for the patent as filed and in the patent as granted. (See disclaimer, Pltf.s' Ex. 2, Vol. III, p. 228; original application, Pltf.s' Ex. 1, Vol. III, pp. 15-21; drawings, Vol. III, pp. 83, 91; patent in suit, Vol. III, pp. 1-10.)

Vol. II, p. 1078 73. That the various elements of each of the combinations and methods of the claims at issue are directed to distortionless sound reproduction from sound on film and cooperate one with another to produce it. (Vol. I, pp. bottom 262-263; 268, Qs42-3; Vol. I, p. 434; and citations to findings Nos. 5, 7, 8, 9 and 10.)

Vol. II, p. 1078 74. That the combinations and methods of the claims at issue are not found in any of the prior art citations and are new and useful.

RESPONDENTS' PROPOSED CONCLUSIONS OF LAW APPROVED BY THE COURT.

1. The claims at issue, as found in finding of fact 23*a*, cover combinations of apparatus features and method steps which enabled the successful establishment of a new art (reproduction of sound from film records by the use of light). Anticipation of such claims is not made out by selecting a part from one prior art citation and parts from others or by modification of prior art devices which were not designed, adapted or actually used for the purpose. (Topliff v. Topliff, 145 U. S. 156; Line Material Co. v. Brady, 7 F. [2d] 48; Hobbs v. Beach, 180 U. S. 384.) Vol. II, p. 1078

2. The patent in suit is entitled to a pioneer status and should be liberally and favorably construed since it covers combinations and method steps enabling the first successful sound reproduction with film records by the use of light. (Curtiss Aeroplane case, 278 F. 454; Window Class case, C. C. A. 3rd, 261 F. 362, at p. 370; Sessions v. Romadka, 145 U. S., at p. 45.) Vol. II, p. 1078

3. None of defendants' citations anticipates the claims at issue since none gives in substance the same knowledge and the same directions as the specification of the patent in suit (for example, none discloses apparatus or methods capable of successfully reproducing sound by light from film records). (Skelly Oil v. Universal Oil, 31 F. [2d] 427, C. C. A. 3rd.) Vol. II, p. 1079

4. The invention of the claims at issue is of patentable merit, involving, first, the discovery of the sources of difficulties causing distortion in the reproduction of sound by light from film records, and second, the application of the remedies for such difficulties. (Eibel Process case, 261 U. S. 43; Consolidated v. Window Glass Mch., 261 F. 362, C. C. A. 3rd.) Vol. II, p. 1079

Vol. II, p. 1079 5. The patentees were entitled to secure in the patent in suit their actual invention as disclosed in their original drawings and specifications and were entitled to amend their claims while their application was pending without regard to the nature or scope of the claims originally made and regardless of competing devices put out shortly before the granting of the patent in suit. (Heller Bros. v. Crucible Steel, 297 F. 39, C. C. A. 3rd.)

Vol. II, p. 1080 6. The alleged failure of the patent in suit to mention all of the merits and advantages of the combinations and method steps disclosed and claimed, does not invalidate the claims. (Mead-Morrison v. Exeter, 225 F., at 496, C. C. A. 3rd; U. S. Mitis Co. v. Midvale, 135 F. 103, C. C., Pa., J. Archbald; Holton v. Pepper, 216 F. 368, D. C., Pa.)

Vol. II, p. 1080 7. The combinations and methods of the claims in suit were adequately disclosed under the provisions of R. S., 4888, in the application for the patent in suit as originally filed. (See citations for findings of fact 6-10.)

Vol. II, p. 1080 8. Claims 9, 18 and 19 of the patent in suit are valid method claims and may properly be included in the same patent with the apparatus claims. (Compare with form of Berliner phonograph method claim 5 of Leeds & Catlin case, 213 U. S. 301; and method claims of Window Glass cases, 261 F. 362, 18 F. [2d] 63, opinions by J. Buffington.)

Vol. II, p. 1080 9. Patents which are inoperative or useless for the purposes of the patent in suit are not anticipations for the latter. (Consolidated v. Window Glass Mach., 261 F. 362, C. C. A. 3rd, other authorities.) The following citations of the defendants are therefore incompetent. Pedersen—(inoperative—see finding of fact No. 54); Cawley patents—(all either inoperative or useless for the purpose—see finding 55); Trowbridge—(inoperative for sound reproduction or to produce uniform motion—

see finding 58); Bell & Tainter—(demonstration of operation not given and impossible for producing uniform motion suitable for sound on film reproduction by light—see finding 57); Ries—(impossible to obtain uniformity of speed suitable for sound on film reproduction by light and uses selenium cell which distorts sound; see finding 59); Terwilliger—(inoperative for intended purposes in picture machines—see finding 68); Bock—(inoperative, Vol. II, p. 918); Cooley—(inoperative, Vol. II, p. 921); Dragoumis—(impossible for producing uniform motion suitable for sound on film reproduction by light—see finding 56).

10. The rule as to anticipation by a foreign patent or publication is very strict. A foreign patent or publication is to be measured as anticipatory not by what might have been made out of it but by what is clearly and definitely disclosed in it. (Seymour v. Osborne, 11 Wall. 516; Carson v. Am. Smelting, 4 F. [2] 463.) Therefore the British patent to Pedersen (see references under Finding 54), the Dragoumis (see refs. re finding 56) and General Phonograph French patents [Vol. V, p. 1371], the Rankine article [Vol. V, p. 1398] and the Duddell British patent [Vol. V, p. 1340], none of which teaches the invention of the claims of the patent in suit, cannot be used as anticipations and the devices thereof cannot be modified for such purpose. Defendants' expert's sketch (Deft.s' Ex. 148, Vol. V, p. 1715) which involves unjustified interpretations and modifications of the Pedersen patent [Vol. V, p. 1349] is incompetent. (See finding 54.) Vol. II, p. 1081

11. Citations from non-analogous prior art cannot be used as anticipations. (Koppers Case, 258 Fed. 122, C. C. A. 3rd.) Therefore defendants' following citations are impertinent for the reasons noted: Trowbridge [Vol. V, p. 1189]—indicator of rate of change of pressures, as in gas engines; Galley [IV, 735]—hand organ; Holst Vol. II, p. 1081

[IV, 895], Momyer [IV, 1133], Terwilliger [IV, 1097] and Anderson [IV, 1081]—picture apparatus not involving sound; Jamieson British patent [V, 1319]—governor for power motors; Royce British patent [V, 1341]—for prime movers such as automobile drives. Also flywheels used on picture projector mechanism—not involving sound or any requirement for uniform motion. (See said patents and findings 37, 38, 58, 65, 66, 68.)

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12. The patents to Cawley relied upon, 1,878,577 [Vol. V, p. 1295] and 1,825,438 [V, 1253], Ries [V, 1215], Trowbridge [V, 1189], Constable [V, 1185], Kunz [V, 1161] and Compton [V, 1227], and Clark patent 1,388,515 [V, 1173], were not granted until after the filing of the application for the patent in suit or until after the effective German application filing dates thereof, and hence said patents neither comprise anticipations nor prior art in respect to the patent in suit. The applications of such later patents could only be used to show prior invention. None of the applications for said patents show prior invention of the subject matter of the claims at issue. (Authorities, see John-Pratt Co. v. Freeman, 201 F. 356; affd. 204 F. 288, C. C. A. 3rd; Ladd v. Walker, 7 F. [2d] 72, C. C. A. 3rd, and by the Court of Customs and Patent Appeals, In re Spencer, 47 F. [2d] 806 [1931]; Allied Metal v. Standard Electric, 57 F. [2d] 296; Farmers' Handy Wagon Co. v. Beaver, C. C. A. 7th, 236 F. 731.)

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13. Anticipations are not made out by the operation of prior devices with important or essential parts discarded. (Eck v. Kutz, 132 Fed. at 779, C. C., Pa., J. Archbald); therefore no weight can be given to the operation of alleged models and parts of various Edison phonographs, Dragoumis, Amet spring connection, and Constable. (See Photos, Deft.s' Ex. 89T, Vol. V, p. 1485; Deft.s' Ex. 89U, Vol. V, p. 1487; Deft.s' Ex. 86A, Vol. V, p. 1467; Deft.s' Ex. 81A, Vol. V, p. 1441; Deft.s' Ex. 83A, Vol. V, p. 1449.)

14. An unappreciated use does not anticipate (Tilghman v. Proctor, 102 U. S. at 711); therefore the first Hoxie machine with alleged brief early and unsuccessful use of flywheel, later discarded, even if it had been established as early enough, is incompetent as an alleged anticipation of the flywheel control feature of the claims at issue because the use of the alleged flywheel was not for the purpose of obtaining flywheel speed control but was for the purpose of providing a crank and a pulley. (See citations for findings 46 and 47.) Vol. II, p. 1082

15. Defendants are under the burden of proving alleged prior uses beyond reasonable doubt. The oral testimony upon which the proofs rest as to the first Hoxie machine and its details of construction, alleged to be a prior use as to certain of the claims, is incompetent and insufficient to establish the facts with the required degree of certainty. (Eibel Process Case, 261 U. S. 45.) Vol. II, p. 1083

16. The alleged crude Story device constitutes merely an abandoned experiment since the work was conducted in private, was unsuccessful, resulting in absolutely nothing useful and no patent application was filed thereon. (Consolidated v. Window Glass Mach., 261 F. 362, at 370, C. C. A. 3rd.) Vol. II, p. 1083

17. The Hoxie work constitutes merely abandoned experiments since the work was conducted in private, resulting in nothing useful, no commercial reproducers were put out and no patent applications were filed until years later after the patentees had demonstrated the value of the invention of the claims at issue. (Bijur v. Kennington, 278 F. 313.) Vol. II, p. 1083

18. The commercial use of the invention of the patent in suit by the patentees in Germany following the completion of their invention and long before others, and Vol. II, p. 1084

the commercial use of the invention continued by their licensees; the extensive use of the invention by others since, and the fact that the invention has completely replaced disk sound pictures, is persuasive of the novelty and patentability of the invention. (Eibel Process case, 261 U. S. 45; Diamond Rubber v. Consolidated, 220 U. S. 428.)

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19. The unsuccessful efforts of others to obtain satisfactory sound on film sound recording and reproducing by light prior to the patentees' date; of Dr. Story with the aid of other scientists of the General Electric Co.; of Prof. Rankine, of Dr. Lee DeForest, even shortly after the patentees' date, of Hoxie and the fact that the Western Electric Co., although it had a sound on disk sound picture machine in use in the summer of 1926, did not put out sound on film sound picture machines until some months after it had had access to Dr. Engl's Tri-Ergon machine and had his advices in the matter, comprise persuasive evidence of the novelty and validity of the patent. (Am. Stainless Steel Co. v. Ludlum, 290 F. 103, 105, C. C. A. 2nd; Todd v. Safe-Guard, 291 F. 613, 614; Eibel Process case, 261 U. S. 47, 71; G. E. Co. v. Mallory, 294 F. 562.)

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20. The efforts of the R. C. A., who is defending these suits, to secure rights thereunder, comprise persuasive evidence of the novelty and validity of the patent. (Schenck v. Diamond Match, 77 F. 208, C. C. A. 3rd; Bostock v. Goodrich 21 F. 316, C. C., Pa.; Pltf.s' Ex. 13; Vol. III, pp. 319, 321.) (See Finding of Fact 30.)

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21. Defendants' citation of many prior art references (about seventy), none showing a solution of the problem presented, is persuasive evidence of novelty and validity of the invention of the patent in suit. (See Ball & Roller Bearing Co. v. Sanford Mfg. Co., 297 Fed. 163; Handy v. American Flyer Mfg. Co., 44 Fed. [2d] 633.)

21a. R. C. A., which is defending these suits, cannot with good grace deny the novelty and patentability of the invention in view of the patents issued to it and its deliberate and persistent efforts in claiming for itself as novel and patentable various features of the patent in suit (although in fact it had no right to such claims because of lack of disclosure or inoperativeness of the devices of the original applications and the late dates of others). (See discussion of R. C. A.'s efforts with Cawley patents [Finding 55, *supra*]; authorities, Cutler-Hammer v. General Electric Co., 6 F. [2d] 376, C. C. A., Bostock v. Goodrich, 21 F. 316, C. C., Pa.) Vol. II, p. 1085

22. The technical defense that the patent in suit is not a joint invention of the three patentees, requires unquestionable proof from the defendants, and all doubts are to be resolved in favor of the patent. (Thropp v. DeLaski, 226 F. 949; also Hall Signal v. Union, 115 F. 638, at 643, C. C., W. D., Pa., J. Buffington.) Vol. II, p. 1085

23. The invention of the patent in suit is a joint invention of the three patentees within the meaning of the statutes. (Thropp v. DeLaski, 226 F. 949, and the testimony of Dr. Engl that the invention was made jointly by the three inventors working together in the same laboratory room; Vol. I, pp. 174; mid. 138; 139; mid. 163; the oaths of the three inventors filed in the application upon the filing of the original application, and again shortly prior to the issuance of the patent; the Film-Kurier article, Deft.s' Ex. 130, Vol. V, p. 1671, cited by defendants to prove lack of joint inventorship, is incompetent, but if it had any weight, it is offset by an article of Vogt's, 1926, Deft.s' Ex. 128, Vol. V, p. 1641. None of the inventors have testified that it was not a joint invention.) Vol. II, p. 1085

24. Paragraph (a) of the disclaimer (Vol. III, p. 228) limits the patent in suit to apparatus wherein, and Vol. II, p. 1086

methods whereby sound is translated by light to or from a film strip moving uniformly past said light. The subject matter of said limitation is entirely consistent and in accordance with the teachings of the patent. The patent discloses translating the sound in that manner only and it was already claimed in several of the claims as issued; for example, see claims 9, 13 and 18 in suit.

Under paragraphs (b), (c) and (e), respectively, claims 9, 13, 18 and 19 are specifically limited to the feature of flywheel control. The subject matter of said limitation is entirely consistent and in accordance with the teachings of the patent which discloses such means of speed control, and this feature is claimed in several of the claims as issued; see for example claims 5 and 7 here at issue.

Under paragraph (d) of the disclaimer, claim 17 is limited to a sprocket forming a part of the carrier progressing means, and to its location with respect to a portion of the periphery of the cylinder already included in the claim. The subject matter of said limitation is entirely consistent and in accordance with the teachings of the patent which fully describes this arrangement; for example, in connection with Fig. 2 of the patent.

No part of the disclaimer broadens or purports to broaden the scope of any claim of the patent.

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25. Even if it be assumed (for discussion only) that the disclaimer to claim 17 adds another element or subelement to the combination of the claim, such a disclaimer is nevertheless permissible and valid (Hurlbut v. Schillinger, 130 U. S. 456, 32 L. Ed. 1011; Strause v. Crane, 235 F. 126.)

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26. The presumption of validity of the patent in suit is unaffected by the disclaimer. (Carnegie Steel case, 185 U. S., at 435, and same case, C. C. A. 3rd, 89 F., at 738, 757.)

27. The disclaimer is not a confession of anticipation in the absence of the disclaimer. (Nelson v. Meyers, 29 F. [2d] 968, C. C. A.; Permutit v. Wadham, 13 F. 454, 457, C. C. A.) Vol. II, p. 1087

28. In so far as the disclaimer may be considered unnecessary, it does no harm and does not prejudice the validity of the patent. (Cambria Steel case, supra, 185 U. S., at p. 436, Marconi v. DeForest, 243 F. 560, 565.) Vol. II, p. 1087

29. The claims in suit as modified by the disclaimer are valid. (See above authorities.) Vol. II, p. 1087

30. The defense of invalidity under R. S., Sec. 4887 (here because of the German patent 387,058 to the same inventors), puts a heavy burden on the defendants which they have not overcome (General Electric Co. v. Alexander, 280 F. 852). Forfeitures are not favored in equity. Vol. II, p. 1087

31. The apparatus of the German patent 387,058 (Vol. V, p. 1544) being inoperative (see finding 70), the patent is impertinent under R. S., Sec. 4887. (General Electric Co. v. Alexander, supra; Aquarama v. Old Mill, 124 Fed. 229.) Vol. II, p. 1088

32. The German patent 387,058 does not invalidate any of the claims at issue, under R. S., Sec. 4887, because there is no substantial identity of invention *claimed* in the foreign patent with that *claimed* in the claims at issue. For a foreign patent to invalidate a United States patent under this section, the invention claimed in the foreign patent must be substantially identical with the invention claimed by the claim or claims of the United States patent which it is sought to defeat. "It is not sufficient that the foreign patent may disclose the invention of the later United States patent where it is not herein claimed." (There are several features Vol. II, p. 1088

claimed in the claims at issue and shown in the United States patent, not even disclosed in the German patent. For differences, see finding of fact 70; authorities, Leeds & Catlin case, 213 U. S. 301; Fireball case, 239 U. S. 156; General Electric Co. v. Alexander, supra; Aquarama Co. v. Old Mill Co., et al., 124 F. 229.)

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33. The claims of the German patent 387,058 are for an apparatus and therefore, also for this reason, it does not patent the same invention as is patented by the method claims here at issue (9, 18 and 19). "A process" (method) "and apparatus by which it is performed are distinct things" • • •. "Claims are independent inventions" and a claim for a method is for a different invention from that of a claim for the apparatus by which the method is performed. (Leeds & Catlin case, 213 U. S. 301; Fireball case, 239 U. S. 156. The substantial legal distinction between methods and apparatus claims is evident from the fact that a U. S. method claim is not infringed by the manufacture of the apparatus by which the method may be performed—the apparatus may be made here and exported for use abroad notwithstanding any U. S. method claim covering its use.)

The German patent No. 387,058 was not a prior art patent with respect to the patent in suit because it was neither a patent (patented in Germany) nor a printed publication, prior to the filing of the application for the patent in suit. (R. S., Sec. 4886.)

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35. The grant of a patent carries with it the presumption of validity and the burden of proof to establish anticipation or lack of invention rests heavily upon a defendant attacking the patent, and the evidence must be very clear and convincing, if indeed every reasonable doubt should not be resolved against him. (Window Glass Mach. Co. v. Smethport Window Glass Co. [W. D. Pa.], 266 F. 85, at p. 93; Ward Baking Co. v. Hazleton Baking Co., 292 F. 202 [M. D., Pa.], at p. 204; T. B.

Woods Sons Co. v. Valley Iron Works [M. D., Pa.], 191 F. R. 196, at 200, affirmed 196 F. 780, C. C. A. 3d; Carnegie Steel Co. v. Cambria Iron Co. [W. D., Pa.], 89 F. 721, at p. 738; Charnbury v. Walden [C. C. D., N. J.], 141 F. 373, at p. 377; Massie v. Fruit Growers Express Co. [D. C., Del.], 31 F. [2d] 463, at p. 464.) Defendants have failed to overcome this burden.

36. That the inventions of the claims at issue are novel and patentable; that claims 5, 7, 9, 13, 18 and 19 are infringed by defendants' PS1 apparatus (diagrams, Vol. III, pp. 327-9) as charged, and claims 9, 13, 17, 18 and 19 are infringed by defendants' PS16 apparatus (diagrams, Vol. III, pp. 330-2) as charged. Vol. II, p. 1090

37. Title to the patent in suit and license rights thereunder rests in the plaintiffs, American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., as pleaded. Vol. II, p. 1090

38. Plaintiffs are entitled to injunctions restraining the defendants from further infringements, and for accountings and costs, as prayed for in the two bills of complaint. Vol. II, p. 1090

PETITIONERS' PROPOSED FINDINGS OF FACT FOUND BY THE COURT.

Vol. II, p. 1101

1. Plaintiff, American Tri-Ergon Corporation, is the owner of the patent in suit No. 1,713,726 (Assignment, Pltf.s' Ex. 14-E), and plaintiff, Tri-Ergon Holding A. G., has certain license rights thereunder (Bills of Complaint, Par. 3[c]).

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2. Altoona Publix Theatres, Inc., the sole defendant in suit No. 971, operates the Grand Theatre at Huntingdon, Pa., in which the alleged infringing apparatus Type PS-16 is installed (Vol. I, pp. 63-4). Wilmer & Vincent Corporation, one of the defendants in suit No. 972, operates the State Theatre at Harrisburgh, Pa., in which the alleged infringing apparatus Type PS-1 is installed (Vol. I, p. 63). Locust Street Real Estate Company, the other defendant in the last named suit, owns the State Theatre (Vol. I, p. 63).

Vol. II, p. 1101

3. Both suits are defended by R. C. A. Photophone, Inc., the talking motion picture subsidiary of the Radio Corporation of America (Vol. I, p. 64). R. C. A. Photophone, Inc., leased the alleged infringing equipment Type PS-16 to the defendant, Altoona Publix Theatres, Inc., and the alleged infringing equipment Type PS-1 to the Locust Street Real Estate Company (Vol. I, p. 64).

Vol. II, p. 1101

4. The patentees of the patent in suit are three Germans, Vogt, Massolle and Engl, who filed the application for the patent in suit in the United States Patent Office on March 20, 1922 (Pltf.s' Ex. 1).

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5. Claims 5, 7, 9, 13, 17, 18 and 19 of the patent are in suit. Claims 9, 13, 18 and 19 are relied upon as to both types of defendants' apparatus; claims 5 and 7 are relied upon as to Type PS-1 only; and claim 17 is relied upon as to Type PS-16 only.

7. The claims do not include motion pictures but are for phonographic apparatus and phonographic methods whether or not used in connection with motion pictures. Vol. II, p. 1102

8. As stated in one of plaintiffs' own exhibits, "A flywheel is the *classical* and unexcelled means of obtaining *uniform rotation*" (Pltf.s' Ex. 44, p. 658). The flywheel has been the everyday tool of the mechanic for a great many years. Vol. II, p. 1102

9. Absolute uniform motion is an unattainable ideal (Vol. II, p. 643). The degree to which uniformity is approached depends on the care exercised by the builder of the machine. Each machine designer determines the degree of uniformity required in practice in each particular machine and he then designs the machine to give that degree of uniformity. The difference in the uniformity of one machine compared with that of another machine is at most merely a matter of degree (Vol. II, p. 644). Vol. II, p. 1102

10. All rotating parts, whether or not made in the conventional form of a flywheel, have momentum and, therefore, all such parts tend to maintain uniform or constant speed (Vol. II, p. 643). The conventional form of a flywheel is a wheel with a heavy rim (Deft.s' Ex. 71, p. 409). But a flywheel is still a flywheel even though it be in the form of a gear, or pulley (Vol. II, pp. 645, 646). The terms "balance wheel", "momentum wheel", and "flywheel" are synonymous (Vol. II, p. 643). Vol. II, p. 1103

11. As found by the Supreme Court nearly 40 years ago in *American Road Machine Co.* v. *Pennock & Sharp Co.*, 164 U. S. 26, pages 34 and 39: Vol. II, p. 1103

> "The knowledge was common that when a continuous power is applied, but the resistance to be overcome is unequal, a fly or balance-wheel will store

some of the power expended during the operation and not needed at one stage, and give it out at another. • • •

"The law of nature was familiarly understood that any moving body tends to continue in motion with a force proportionate to its speed and weight; and it was well known that the function of fly-wheels and balance-wheels was, in the language of Mr. Brevoort, 'to absorb energy when the machine is moving at greater speed with the least resistance, and to give it out again when the parts meet with greater resistance.' "

Therefore, what a flywheel always does is to store up energy when its speed is increased and give up energy when its speed is decreased (Vol. II, pp. 643-4). If the resistance to motion decreases so that the shaft starts to speed up, the flywheel absorbs the energy and resists and minimizes the increase of speeds; and if the resistance to motion of the shaft increases so that it starts to slow down, the flywheel gives out its stored energy and resists and minimizes the decrease in speed.

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12. The principles relating to uniform motion and its attainment by the use of a rotating heavy mass or flywheel were not only thoroughly understood many years ago but their application had become merely a routine matter of mathematics in machine design (Vol. II, p. 644). The principles were so well known that they appeared in text books (Deft.s' Ex. 71) and in a decision of the Supreme Court many years before any date important here (*supra*).

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13. There is an almost unlimited number of prior analogous uses of flywheels for giving constant speed in various types of machines but flywheels were also used for that purpose in the phonographic art from the beginning of that art.

14. Edison was the father of the phonograph and also the father of the motion picture as known today. Edison applied for his patent No. 227,679 (Deft.s' Ex. 74, Item 3) in 1879, in which he disclosed a large flywheel, mounted directly on the shaft which carried the sound record so that the flywheel controlled the speed of the sound record directly at the point at which the sound was recorded and from which it was reproduced, *i. e.*, the translating point. It appears from this Edison patent that as early as 1879 Edison fully understood the principles of uniform motion and that uniform motion could be obtained in a phonograph by means of a flywheel. Notwithstanding he was the first to use a flywheel in a phonograph, Edison's claim for this use of a flywheel was rejected by the Patent Office as being "a mere double use of a flywheel as ordinarily used with machinery for the purpose of securing uniformity of motion" (Deft.s' Ex. 73, p. 15) and, because it "involved but the exercise of ordinary good judgment and did not require invention" (Deft.s' Ex. 73, p. 17). Vol. II, p. 1104

15. Edison used heavy flywheels in his commercial phonographs as early as 1878, as appears from the Edison instruction book (Deft.s' Ex. 120-B), an original of which is in the Smithsonian Institution. On page 3 of that book the phonograph with its heavy flywheel mounted directly on the mandrel shaft is shown, and it is stated, "Heavy flywheel, to give uniform motion (Very important)". Flywheels for obtaining uniform motion in Edison phonographs are also disclosed in Edison patents Nos. 386,974 of 1888, 499,879 of 1893 and 513,095 of 1894 (Deft.s' Ex. 74, Items 7, 8, 9). From 1879, when Edison stated and applied the principles of uniform motion to the phonograph, until the present time those principles have been employed in all phonographs. One or more rotating heavy masses have been employed without exception, the size of the mass being determined by the degree of speed constancy desired in each particular machine. Vol. II, p. 1105

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16. In recording commercial phonograph records for home use, Edison exercised particular care that they should be recorded with a high degree of uniformity. Defendants' Exhibits 31 and 155 are two original Edison machines which were used at the Edison recording laboratory in New York considerably before 1921 for recording Edison commercial phonograph records. Each of these machines has a heavy flywheel directly and rigidly mounted on the record mandrel shaft. These flywheels produce a high degree of speed constancy as was shown by defendants' demonstration during the trial.

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29. Optical slits are disclosed in Bell and Tainter patent No. 341,213 of 1886 (Deft.s' Ex. 74, Item 4; see Fig. 1, and p. 1, lines 61-69, p. 2, lines 68-88); Duddell patent No. 24,546 of 1902 (Deft.s' Ex. 74, Item 40; see p. 3, lines 22-40); in the application for Trowbridge patent No. 1,447,913 (Deft.s' Ex. 74, Item 28), filed in 1920, in the Trowbridge machine of 1919; and in the article by Rankine in the "Proceedings of the Physical Society of London" of 1920 (Deft.s' Ex. 74, Item 48). Moreover, Bell and Tainter not only disclosed but also received in their above mentioned patent which issued in 1886 the following combination claim, including the optical slit and mechanism (the flywheel) for giving uniform motion to the photographic tablet:

> "The apparatus for recording sound vibrations photographically, consisting of the following elements in combination, namely: *the condensing-lens, the plate or block provided with a slit,* the means for varying the quantity or intensity of the energy transmitted through said slit, the recording-tablet, *the lens for projecting an image of the slit on the tablet, and the mechanism for giving a uniform surface-speed to the tablet under said image, substantially as described.*"

30. A damped-spring phonograph drive is shown in the prior Constable patent No. 1,425,177 (Deft.s' Ex. 74, Item 27), and an inherently damped resilient phonograph drive is shown in combination with a flywheel in Amet patent No. 1,221,407 (Deft.s' Ex. 74, Item 22). Other examples of resilient drives in combination with a flywheel are: Gally, 210,249; Holst, 587,527; Wood, 724,645; Ebeling, 1,255,143; Lanchester, 1,085,443; Rowland, 691,667; Jamieson British, 2,814; Baron British, 21,371; French patent, 414,788; and French patent of Addition, 10,377. (See Deft.s' Exs. 74 and 75.) Vol. II, p. 1115

PETITIONERS' PROPOSED CONCLUSIONS OF LAW APPROVED BY THE COURT.

52. The Treaty of Berlin did not give the patentees the right to carry the effective date of the application for the patent in suit (*i. e.*, March 24, 1921) back to the filing date of the main German patent No. 387,058 (*i. e.*, May 23, 1920). Vol. II, p. 1121

53. The Treaty of Berlin did not confer on German inventors any additional priority rights over and above those conferred by the Nolan Act (35 U. S. C. 80). Vol. II, p. 1121

54. Even if the Treaty of Berlin should be construed as contemplating additional priority rights for German inventors, nevertheless such construction rests upon the adoption by the Treaty of Berlin of Section 308 of the Treaty of Versailles, which section was not self-executing and no supporting legislation has ever been enacted in aid thereof. Vol. II, p. 1121